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A monthly publication of the Geological Survey
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W83-03501 -- W83-03850

The Secretary of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

PREFACE

Selected Water Resources Abstracts, a monthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. These documents cover water resources as treated in the life, physical, and social sciences and the related engineering and legal aspects of the characteristics, supply condition, conservation, control, use, or management of water resources. Each abstract includes a full bibliographic citation and a set of descriptors which are listed in the **Water Resources Thesaurus.** The abstract entries are classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the then Federal Council for Science and Technology.

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Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
U.S. Geological Survey, MS 421
Reston, VA 22092

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04 WATER QUANTITY MANAGEMENT AND CONTROL

Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION

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06 WATER RESOURCES PLANNING

Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

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SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1B. Aqueous Solutions and Suspensions

SECOND ROW MOLECULAR ORBITAL CALCULATIONS. 5. A MINIMAL BASIS INDO FOR NA-CL,
North Dakota State Univ., Fargo. Dept. of Chemistry.
M. S. Gordon, M. D. Bjorke, F. J. Marsh, and M. S. Korth.
Water Resources Research Institute Completion Report, North Dakota State University, Fargo, January 1983. 9 p, 5 Fig, 18 Tab, 18 Ref. OWRT A-045-NDAK(2), 14-34-0001-7071.

Descriptors: *Bonding, *Barriers, Theoretical analysis, Model studies, *Sodium Chloride, *Molecular structure.

An INDO method is developed for molecules containing Na-CL. Using only valence s and p orbitals, the parametrization is carried out in the spirit of the approach originally taken by Pople and coworkers. The reliability of the method is tested by calculating geometries, dipole moments, and internal rotation barriers for approximately 100 molecules. The improvement in predictive ability relative to previous parametrizations is considerable. Predicted geometries are nearly as good as those for STO3G. Dipole moments of molecules containing Si and Cl are in excellent agreement with experiment, while for P and S the agreement is only fair. This simple parametrized model provides accurate results with little use of computer time and allow calculations of properties of dissolved constituents to be made .
W83-03613

2. WATER CYCLE

2A. General

CURRENTS IN SOUTH SAN FRANCISCO BAY,
California Univ., Berkeley. Hydraulic Engineering Lab.
For primary bibliographic entry see Field 5B.
W83-03690

WATER CONSERVATION AND GROUNDWATER RECHARGE ON EASTERN LONG ISLAND,
New York State Coll. of Agriculture and Life Sciences, Ithaca. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2F.
W83-03703

A PARAMETRIC MODEL FOR PEAK FLOW PREDICTION IN UNGAGED EPHEMERAL WATERSHEDS,
Nevada Univ. System, Reno. Desert Research Inst.
A. D. Truschel, and M. E. Campana.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-249698, Price codes: A06 in paper copy, A01 in microfiche. Publication No 41083, July 1983. 108 p, 30 Fig, 9 Tab, 46 Ref. 2 Append. OWRT B-122-NEV(1), 14-34-0001-0232.

Descriptors: *Parametric hydrology, *Flood peak, *Ephemeral streams, Quasi-linear spatially-distributed cell model, *Arid-zone hydrology, Watershed management, Oklahoma, Texas, Arizona, Storm runoff, Model studies.

The prediction of peak flows from ungaged ephemeral watersheds is an important aspect of arid zone engineering hydrology. Sophisticated physically based models are currently available for the estimation of peak flows; however, these models can be difficult to use and generally require detailed information on watershed properties. Parametric runoff models, while lacking complexity, require large amounts of historical rainfall-runoff data for calibration, data that are unavailable in ungaged watersheds. To overcome these difficulties, a physically based model of an ephemeral watershed was used to generate synthetic calibration data. These data were then used to calibrate a special type of parametric model, a quasi-linear spatially-distributed cell model. Prior to calibration, an optimum-sized unit area (cell size) was determined for the cell model. The calibration phase consisted of developing relations between the cell storage constants of the parametric model and combinations of the influential hydraulic parameters of the physically based model. Since the latters's parameters represent measurable watershed properties, the relations can then be used to apply the cell model directly to ungaged watersheds. The calibration method was validated by applying it to 53 storm runoff events from ephemeral watersheds in Oklahoma, Texas and Arizona. Peak runoff rates predicted by the cell model showed poor correlation with actual rates. Primary reasons for the poor correlation can be attributed to the lack of spatially-distributed rainfall inputs, the failure to consider spatial variance in infiltration properties during calibration and a failure to consider channel transmission losses explicitly in the cell model.
W83-03778

OCCURRENCE PROBABILITIES OF ANTECEDENT MOISTURE CONDITION CLASSES IN INDIANA,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
D. D. Gray, and C. B. Burke.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-253302, Price codes: A06 in paper copy, A01 in microfiche. Technical Report No 159, June 1983. 97 p, 24 Fig, 23 Tab, 28 Ref, 3 Append. OWRT A-060-IND(2).

Descriptors: *Antecedent moisture, Soil water, Rainfall infiltration, *Rainfall-runoff relationships, Excess rainfall, *Computer programs, Model studies, *Indiana.

Discrete Antecedent Moisture Condition (AMC) classes are the simplest means to account for the influence of initial watershed moisture on runoff. AMC classes are used to adjust the abstraction parameters in two widely used hydrologic models: the Soil Conservation Service Curve Number method and the Illinois Urban Drainage Area Simulator computer program (ILLUDAS). In this report, a total of 258 years of daily weather observations at 10 Indiana stations has been used to estimate the seasonal and monthly occurrence probabilities of the Curve Number and ILLUDAS AMC classes. Similar results can now be obtained for any location in Indiana by interpolation. This information will provide guidance to hydrologists who must postulate an AMC class for use in design calculations. The methodology of this study is explained and justified. A listing of the computer program used to analyze the data is included. Shortcomings of the present AMC criteria are discussed, and the results of certain possible modifications are presented. Cumulative Distribution Functions of 5-day antecedent rainfall are tabulated so that future researchers can investigate alternative criteria without having to reanalyze the original data.
W83-03818

RELATIONSHIPS AMONG PRECIPITATION, SNOWMELT, SUBSURFACE FLOW, GROUNDWATER RECHARGE, AND STREAMFLOW GENERATION IN THE CLEAR CREEK WATERSHED, EASTERN SIERRA NEVADA,
Nevada Univ. System, Reno. Desert Research Inst.
R. L. Boone, M. E. Campana, and C. M. Skau.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-253344, Price codes: A07 in paper copy, A01 in microfiche. Publication No 41084, July 1983. 113 p, 40 Fig, 6 Tab, 94 Ref, 4 Append. A-089-NEV(1), 14-34-0001-9030.

Descriptors: *Groundwater recharge, Hillslope hydrology, *Subsurface flow, *Snowmelt, Tensiometers, Piezometers, Soil moisture, Soil temperature, *Nevada, Clear Creek watershed, Sierra Nevada, Forest watersheds, *Surface-groundwater relations, *Precipitation.

An understanding of hillslope hydrologic processes in the forested watersheds of the Sierra Nevada is requisite to the quantification of water quality, groundwater recharge and streamflow generation. A field study utilizing a tensiometer-transducer network, piezometers, psychrometers and flumes was initiated in a portion of the Clear Creek watershed in the Carson Range of the Sierra Nevada. The investigation sought to examine the relationships among precipitation, snowmelt, groundwater recharge, subsurface flow and streamflow generation during the fall of 1982 and the winter of 1983 as well as provide a benchmark for future similar studies in the Sierra. No significant subsurface stormflow was observed during the study period, although this would undoubtedly contribute to streamflow during spring snowmelt season. Snowmelt at the snow/ground interface was absent during the winter, although soil thermal gradients were sufficient to prevent soil freezing. Deep percolation (potential groundwater recharge), derived from the snowpack, occurred continuously during November through mid-Friday at two locations. Additional pulses of deep percolation from rain/snow events in December and January were superimposed over the existing downward flow field in the soil. The local groundwater system may also derive recharge from higher zones in the watershed, where soils are thinner. The deeper portion of the groundwater system may be linked to a joint system in the study area.
W83-03822

AGRO-ECOLOGICAL REGIONS OF WESTERN RAJASTHAN,
Central Arid Zone Research Inst., Jodhpur (India). Div. of Basic Resources Studies.
A. K. Sen, and K. N. Gupta.
Journal of Arid Environments, Vol 5, No 3, p 221-234, 1982. 6 Fig, 9 Tab, 21 Ref.

Descriptors: *Arid lands, *Agricultural hydrology, *Mapping, Groundwater, Crop yields, Soil properties, Topography, Semiarid lands, Deserts, Climates, Drainage, Rajasthan, *India.

The agro-ecological regions of western Rajasthan were classified and mapped. The quantitative relationship between agricultural characteristics and environmental factors in the arid zone was determined by close examination of three variables: topoclimatology, including local climate, topography, drainage, ground water and soils; cropping patterns, including the delineation of the area of one crop or a related group of crops; and agrodemography. These variables were used to generate a variety of indices, which in turn formed the basis for subdivision of the area into agro-ecological zones. Based on the relationships between these indices, the region has been mapped into two macro- and four micro-agro-ecological units. These mapping units are of homogeneous agricultural fitness. Finally, the characteristics and agricultural peculiarities of the regions as reflected by topoclimatology including soil, ground water, cropping pattern, crop yields, agrodemographic and agro-economic aspects are considered. (Baker-FRC)
W83-03850

2B. Precipitation

ON THE ROLE OF LARGE SCALE ENERGETICS IN THE ONSET AND MAINTENANCE OF SUMMER MONSOON--II: MOISTURE BUDGET,
Indian Inst. of Tech., New Delhi. Centre for Atmospheric and Fluids Sciences.
U. C. Mohanty, S. K. Dube, and P. C. Sinha.
Mausam, Vol 33, No 3, p 285-294, July , 1982. 6 Fig, 7 Ref.

Descriptors: *Monsoons, *Heat balance, *Hydrometeorology, Rainfall, *India, Climatology, Moisture, Latent heat, Tropical regions, Precipitation, Potential rainfall.

The moisture and moist static energy budget over a large monsoon area from 20 degrees S to 40 degrees N and 0 degrees E to 150 degrees E in May-July 1979 were studied with the help of a reliable, complete data set, which consisted of twice daily First GARP Global Experiment level IIIb analysis temperature, relative humidity, geopotential and wind fields. The daily variation of latent heat energy increased from May 4 to June 5. The horizontal import and diabatic sink increased from June 3-6 and remained high until July 3. These characteristic indicators of monsoon activities were evident 2 weeks before the onset of the monsoon over the Kerala coast and remained high during the active monsoon period. After July 5 there was a net transport of moisture from the region, indicating a weakening of the monsoon about 10 days before the break monsoon prevailed (in 1979 on July 16). Daily variation in the moisture budget parameters were also reliable indicators of monsoon activity over India. The net moist static energy remained almost steady for the entire period. Daily variation of the moist static energy budget parameters did not show any trends. (Cassar-FRC)
W83-03786

AN ANALYSIS OF MAURITIAN WINTER RAINFALL,
Meteorological Service, Vacoas (Mauritius).
B. M. R. Pathack.
Mausam, Vol 33, No 3, p 361-372, July, 1982. 5 Fig, 3 Tab, 15 Ref.

Descriptors: *Rainfall distribution, *Seasonal variation, *Tropical regions, *Mauritius, Statistical analysis, Spectral analysis, Precipitation.

Long-term winter rainfall records (100 years) for the island of Mauritius were examined by statistical and spectral analysis. The cyclone-free months of June-August were considered. Drier areas were more variable in rainfall. Significant peaks of 10-13 years were thought to be associated with the solar cycle. Less pronounced peaks were seen for 2, 3-4, and 16-20 year periods. Wet winters were recorded in 1885, 1909, 1926-27, 1939-40, 1951-54, 1961-62, and 1972. Dry winters were recorded in 1883-84, 1886, 1902-03, 1915-16, 1921-23, 1942-48, and 1956-57. Data contained spectral peaks, but very few were significant. (Cassar-FRC)
W83-03787

HYDROMETEOROLOGICAL STUDY OF SEVERE RAINSTORMS OF NORTH BIHAR,
Meteorological Office, Patna (India).
A. K. Ghosh, and K. Prasad.
Mausam, Vol 33, No 3, p 385-390, July, 1982. 4 Fig, 2 Tab, 6 Ref.

Descriptors: *Rainstorms, *Monsoons, *Hydrometeorology, Bihar, *India, Ganges River, Rainfall distribution, Precipitation, Storms, Flood forecasting.

A hydrometeorological analysis of severe rainstorms of the north Bihar region in India (Gandak, Burhi Bandak, Bagmati, Adhwara, and Kamala catchments, all draining into the Ganges River) shows that most severe storms occur in September. These rainstorms are mostly associated with monsoon depressions and low pressure areas. During September the heavy rainfall centers lie mostly in front and to the right of the track of the pressure systems. The bearings of the heavy rain centers relative to storm tracks range from -45 degrees to +95 degrees. The distances of these centers from the center of the pressure systems range between 110 and 520 km. (Cassar-FRC)
W83-03788

PROBABILIITY ANALYSIS OF SHORT PERIOD RAINFALL IN DRY FARMING TRACT IN INDIA,
Meteorological Office, Poona (India).
R. P. Sarker, B. C. Biswas, and N. N. Khambete.
Mausam, Vol 33, No 3, p 269-284, July, 1982. 12 Fig, 6 Tab, 8 Ref.

Descriptors: *Dry farming, *Rainfall distribution, Precipitation, *India, Monsoons, Areal precipitation, Agriculture.

Minimum assured rainfall has been calculated for probability levels from 10 to 90% for the dry farming region in India, 87 districts in 9 states. Rainfall, annually 400-1000 mm, is the limiting factor in agriculture. The number of rainy days per year ranges from 19 to 61. Seven homogeneous rainfall zones were identified to help in effluent agricultural planning. In some regions a kharif crop is impractical, but prospects for rabi crops are fairly good. Monsoon activity is lowest throughout the entire dry farming tract during weeks 32 to 34. Kharif crop prospects are very good in a high rainfall belt in the eastern part of the tract between 18-23 degrees north latitude and east of 75 degrees longitude. Knowing the assured rainfall distribution for the major areas, the specific cropping patterns for local areas can be further refined by consideration of soil characteristics and evapotranspiration demands. (Cassar-FRC)
W83-03800

PATH OF A VORTEX IN A SEMI-INFINITE REGION WITH A STREAMING MOTION ALONG A PLANE WALL BOUNDARY HAVING A SEMICIRCULAR BAY OR BULGE,
Meteorological Office, Calcutta (India).
For primary bibliographic entry see Field 2E.
W83-03807

2D. Evaporation and Transpiration

WATER-USE PRODUCTION FUNCTIONS OF SELECTED AGRONOMIC CROPS IN NORTHWESTERN NEW MEXICO, PHASE II,
New Mexico State Univ., Las Cruces. Dept. of Agricultural Engineering.
C. E. Kallsen, E. J. Gregory, and T. W. Sammis.
New Mexico WRRI Report No 155, October 1982. 130 p, 29 Fig, 43 Tab, 25 Ref, 7 Append.

Descriptors: *Water use efficiency, *Soil-water-plant relationships, *Evapotranspiration, *Crop production, *Transpiration, Barley, Beans, Alfalfa, Economic yield, Evapotranspiration control, Evapotranspiration potential, Seasonal variation, Irrigation, *New Mexico.

The water requirement for growth of spring barley, pinto beans, and alfalfa was investigated in northwestern New Mexico. Results strongly suggest that the level of nitrogen fertility does not alter the water-use efficiency (WUE) of spring barley when WUE is expressed as a function of transpiration. WUE may change, depending on irrigation scheduling, if WUE is expressed as a function of evapotranspiration. The difference is attributed to differential soil-water evaporation. Further evidence supports the hypothesis that a common function exists independent of season, with respect to a given crop, relating economic yield to transpiration. Crop coefficients based on various methods of calculating potential evapotranspiration were found to vary as much as 50% between years due in part to the difference in the evaporation component of the measured evapotranspiration. Although the study was unable to determine the effect of nitrogen fertility on pinto beans, the spring barley data suggest that nitrogen fertility does not affect the WUE when the efficiency is expressed as the weight of economic yield produced per depth of water transpired. The value of the potential evapotranspiration measurement for predicting the crop evapotranspiration requirement is seriously questioned by the date produced. Caution should be exercised in using crop coefficients to predict alfalfa, pinto beans, and spring barley seasonal or intraseasonal water requirements when the crops are grown under conditions requiring frequent light irrigation. (Garrison-Omniplan)
W83-03560

EVAPOTRANSPIRATION FROM HETEROGENEOUS MOUNTAIN MEADOWS,
Wyoming Univ., Laramie. Coll. of Agriculture.
J. Borrelli, and R. D. Burman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-246397, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Series No 86, Water Research Center, July 1982. 35 p, 2 Fig, 8 Tab, 1 App, 10 Ref. OWRT A-026-WYO(1), 14-34-0001-9054.

Descriptors: Irrigation requirements, Crop production, Meadows, Return flow, *Evapotranspiration, Grasses, Lysimeters, *Little Laramie River Valley, *Wyoming, *Blaney-Criddle method, Mountain meadows.

The evapotranspiration rates of irrigated mountain meadow grasses were measured using non-weighing lysimeters during the 1979 and 1980 growing seasons. The lysimeters were located in a line across the Little Laramie River Valley near Laramie, Wyoming. The 1967 version of the Blaney-Criddle method for estimating evapotranspiration was calibrated using the lysimeter data (USDA, SCS, 1967). Lysimeters 1, 2, 3, 8, and 9 were located in areas that were not irrigated. However the E sub t rates measured by lysimeters 2, 3, and 9 were as great as E sub t rates measured by lysimeters in the irrigated portion of the mountain meadows. The high water table in these non-irrigated areas provided an extra source of water. The return flows from irrigated areas appeared to provide the bulk of the groundwater.
W83-03684

A 'MICRO-LYSIMTER' METHOD FOR DETERMINING EVAPORATION FROM BARE SOIL: DESCRIPTION AND LABORATORY EVALUATION,
Illinois Univ. at Urbana-Champaign. Dept. of Agronomy.
C. W. Boast, and T. M. Robertson.
Soil Science Society of America Journal, Vol 46, No 4, p 689-696, July/August, 1982. 8 Fig, 1 Tab, 16 ref.

Descriptors: *Evaporation, *Measuring instruments, *Lysimeters, Soil moisture availability, Soil water, Water balance.

A micro-lysimeter approach is developed which avoids some of the problems of perturbed lower boundary conditions and some of the problems inherent in the construction of large lysimeters. This new method estimates evaporation from soil and consists of pushing a thin-walled cylinder 76 mm in diameter into field soil, removing the soil-filled cylinder from the field, closing the bottom to make it water-tight, determining the mass of the microlysimeter, replacing it in the field with its top surface even with the surrounding soil, leaving it exposed to environmental conditions for a period of time and redetermining its mass. Evaporation loss from the micro-lysimeter is the difference between the two masses. The method requires very little equipment, although it is labor-intensive. Evaporation can be determined under circumstances where traditional methods are impractical or impossible. For example micro-lysimeters can be used at a large number of locations for just a few days, where the cost of larger lysimeters would be prohibitive. Evaporation can be measured as a function of distance from a crop row, under conditions of partial cover and partial shading, or in other situations for which the spatial resolution of traditional lysimeters is too large. (Baker-FRC)
W83-03783

2E. Streamflow and Runoff

DIRECT MEASUREMENTS OF SECONDARY CURRENTS IN NATURAL MEANDER (DIREKTMESSUNG VON SEKUNDARSTROMUNGEN IN NATUERLICHEN MAANDERN),
C. Thorne, J. Bathurst, and R. Hey.
Wasserwirtschaft, Vol 71, No 10, p 283-288, October, 1981. 6 Fig, 1 Tab, 24 Ref.

Descriptors: *Rivers, *Meanders, *Flow velocity, *Water currents, *Field tests, Natural flow, Water circulation, Flow, Flow discharge, Flow rates,

Mathematical equations, Federal Republic of Germany.

Field measurements of secondary and primary velocities at a river meander are presented. At a bend, these illustrate the existance of a main secondary circulation cell which carries surface water towards the outer bank and bed water towards the inner bank. At the inflection plant between bends the data indicates that the main cell for the downstream bend originates at the bed and develops upward, thereby displacing the relic main cell of the upstream bend. Measurements at different discharges indicate that secondary circulation has less effect on flow hydraulics at high discharges than at medium discharges. At bends, the secondary circulation distorts the distributions of velocity and boundary shear stress, particularly close to the outer bank. This must be taken into account in bank protection and river training schemes. (Author's abstract)
W83-03525

REGIONAL FLOOD FREQUENCY ANALYSIS FOR ALASKA,
Alaska Univ., Fairbanks. Inst. of Water Resources.
J. R. Janowicz, and D. L. Kane.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-235531, Price codes: A03 in paper copy, A01 in microfiche. Completion Report IWR-105, March 1983. 44 p, 16 Fig, 2 Tab, 39 Ref. OWRT A-071-ALAS(1), 14-34-0001-2101.

Descriptors: *Peak flow, Modeling, *Flood frequency, *Ungaged watersheds, Hydrologic data, *Alaska, Regional analysis, Design flow.

The objective was to develop a technique for determining peak design flows from ungaged watersheds throughout the state. First, the state was divided into six hydrologic units based on physiography, climate, and patterns of runoff. These were reduced to three hydrologic regions using multiple discriminate analysis. The lack of data in the northern and western parts of the state made it statistically impossible to separate out these hydrologic areas. Four theoretical probability distributions were fit to sample data reported by the U.S. Geological Survey, Water Resources Division. Only data with at least five years of record were used. Using the developed goodness of fit criteria, the 2-parameter log normal distribution was shown to fit the sample data better than the other methods. From flood frequency analysis, regional envelope curves were developed for selected return periods. A similar exercise was carried out for maximum observed flows to give an indication of upper flood limits. Finally, dimensionless frequency curves were developed for three hydrologic regions. These curves can be used to provide conservative estimates of flows for three hydrologic areas.
W83-03611

A STUDY OF LOW FLOWS USING DATA FROM THE SEVERN AND TRENT CATCHMENTS. PART II: FLOW FREQUENCY PROCEDURES,
J. Pirt, and C. M. Simpson.
Journal of the Institution of Water Engineers and Scientists, Vol 36, No 6, p 459-469, December, 1982. 5 Fig, 4 Tab, 13 Ref.

Descriptors: *Low flow, *River flow, *Drought, Flow characteristics, Severn River, Trent River, *United Kingdom, Streamflow forecasting, Flow frequency curves.

Low flows in ungaged regions of the Severn and Trent catchments were estimated by preparing flow frequency curves from data from 11 gaging stations. Data fitted a Gumbel type 1 distribution. Zero flow for each catchment was obtained at a return period of about 200 years. The average of the annual series of the minimum weekly flows had a return period of 2.33 years. The return period of the minimum 7-day flows as determined from the distribution was 19-38 years, average 23 years. This minimum flow was experienced in the drought of 1976. Independent variables in a stepwise linear regression were a permeability index, ageological index, stream frequency, dry weather flow yield, surface deposit index, mean annual effective precipitation, average catchment altitude, and stream slope. Application of the flow frequency curves to 6 other catchments showed that the method was more reliable than previous methods. (Cassar-FRC)
W83-03656

INSTREAM FLOW REQUIREMENTS FOR FISH AND FISHERIES IN MARYLAND,
Maryland Univ., Solomons. Chesapeake Biological Lab.
C. F. Tsai, and M. L. Wiley.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-249672, Price codes: A06 in paper copy, A01 in microfiche. Water Resources Research Center Completion Report Univ. of Maryland, College Park, June 1983. 90 p, 21 Fig, 10 Tab, 47 Ref. OWRT B-038-MD(1), 14-34-0001-0266.

Descriptors: Piedmont streams, Hydraulic characteristics, volume flow, *Instream flow, Piedmont fishes, Species, Diversity, Fish abundance, Fish biomass, *Maryland, Fisheries, Low flow.

Fishes in Piedmont streams of Maryland were captured by electroshocker during low flow conditions to allow estimates to be made of minimum flow needed to sustain fish populations and communities. Hydraulic characteristics (area, width, depth, water velocity) were linearly correlated with volflo (volume flow). Diversity (H) of the fish community formed a hyperbolic function with volflo, the infection occurring near H = 1.03 and a volflo of 3 cfs (cubic feet per second). Both numerical abundance and biomass of fish per unit of volflo gave negative linear correlations with volflo. Total number of fish in a 400-ft stream section and volflo were curvilinearly related (second degree polynomial), with a peak of 734 fish at 2.48 cfs volflo, but total weight of fish increased linearly with volflo, suggesting that above 2.48 cfs volflo that fish became less numerous but larger in size. Each species had minimum volflo requirements and this made it difficult to establish minimum volflo criteria that were suitable for all species. The number of species per unit of volflo increased to a maximum of 25 species at 3 cfs volflo, which is close to 2.48 cfs, the value at which total abundance and species diversity were greatest and the species composition shifted from small headwater species to large river species. Therfore, 3 cfs volume flow (equivalent to a stream width of 13.9 feet at riffles and 17.8 feet at pools) may be considered as the minimum for fishes during low flow conditions in Piedmont streams of Maryland.
W83-03776

PATH OF A VORTEX IN A SEMI-INFINITE REGION WITH A STREAMING MOTION ALONG A PLANE WALL BOUNDARY HAVING A SEMICIRCULAR BAY OR BULGE,
Meteorological Office, Calcutta (India).
J. C. Mandal.
Mausam, Vol 31, No 1, p 101-110, January, 1980. 14 Fig, 6 Ref.

Descriptors: *Vortices, *Streamflow, *Mathematical models, Model studies, Mathematical equations, Eddies, Flow, Multiphase flow.

An attempt is reported to study the motion of a vortex in a two dimensional steady flow in presence of a plane wall with a semi-circular bay or bulge. This problem has applications in both hydrologic and atmospheric contexts. The technique of transformation has been used to study the problem. The stagnation points determined from both the graphical and analytical methods have been found to agree with each other. The problems arising in the presence of more than one vortex can be solved by the method presented. Since this paper deals with the motion of a vortex in a perfect fluid and in a two-dimensional uniform stream, it has limitations when applied to natural atmospheric vortices, where the effect of friction and the variation of strength of the vortex with height are to be considered and where the stream in which it is embedded is not uniform, However, the orographical effect on the motion of vortexes as found here may be helpful in practical cases. (Baker-FRC)
W83-03807

A SEVERE FLOOD IN LUNI BASIN, WESTERN RAJASTHAN DURING JULY 1979–A CASE STUDY,
Central Arid Zone Research Inst., Jodhpur (India).
K. D. Sharma, N. S. Vangani, P. C. Chatterji, and G. Singh.
Mausam, Vol 33, No 3, p 377-384, July, 1982. 5 Fig, 4 Tab, 5 Ref.

Descriptors: *Flood data, *Monsoons, *Rainfall distribution, Rajasthan, Luni River, *India, Historic floods, Flood spreading, Sediment transport.

In July 1979 a flood devastating to agricultural fields, irrigation projects, and other property occurred in the Luni River basin, western Rajasthan, India. Several factors contributed to the severity of the flood. Heavy to very heavy monsoon rains persisted over the region from July 15 to 19, releasing 11.7 billion cu m of water and flooding 20% of the 34,866 sq km basin. Heaviest rains were in the northeast where 700-900 mm of rain fell during the 5 days. The entire basin is composed of impervious rock formations underlying thin layers of alluvium (1-4 m). A peculiarity of this year system is its tendency for floods to expand and disappear rapidly with little bed scour. As a result, the river tributaries changed from widths of 40-747 m preflood to 524-1362 m postflood. Sediments deposited were coarse sand and gravel, indicative of the torrential nature of the rainfall and short distance of sediment transport. (Cassar-FRC)
W83-03808

2F. Groundwater

GROUNDWATER RESOURCES OF THE TEXAS RIO GRANDE BASIN,
Texas Univ. at Austin. Dept. of Environmental Health Engineering.
R. J. Charbeneau.
Natural Resources Journal, Vol 22, No 4, p 957-971, October, 1982. 2 Fig, 3 Tab.

Descriptors: *Water supply, *Water requirements, *Water demand, *Groundwater, *Groundwater management, Groundwater mining, Water supply development, Water resources development, Resources development, River basin development, Aquifers, Reservoirs, *Texas, Rio Grande.

The groundwater resources of the Texas Rio Grande Basin are important as a water supply for domestic, municipal, manufacturing, power, mining, livestock, and irrigation purposes. Water supply is adequate to meet needs through the year 2000. The spring flow from the Edwards-Trinity and Carrizo-Wilcox aquifers is regulated by the International Amistad and Falcon Reservoirs. These surface water supplies combined with pumpage for irrigation from the Rio Grande and the Gulf Coast Aquifer meet the neeeds of the lower basin. Groundwater shortage problems exist only in the El Paso-Ciudad Juarez area. Here mined groundwater is being replaced with saline water. The water supply in this area is uncertain in the year 2000. Texas, Mexico, and New Mexico must cooperate to see there is an adequate water supply in the future. (Small-FRC)
W83-03503

COMBINED MOVEMENT OF GROUNDWATERS AND MOISTURE OF THE ZONE OF AERATION,
Vsesoyuznyi Nauchno-Issledovatel'skii Inst. Gidrogeologii i Inzhenerdoi Geologii, Moscow (USSR).
V. V. Badov, and A. A. Kiselev.
Water Resources (English Translation), Vol 9, No 1, p 1-10, January-February, 1982. 5 Fig, 31 Ref. Translated from Vodnye Resursy, No 1, p 16-26, January-February, 1982.

Descriptors: *Groundwater movement, *Model studies, Mathematical equations, *Aeration zone, Aeration, Zones, Moisture profiles, *Soil moisture, *Soil water movement.

A model is proposed which reflects the main hydrodynamic characteristics of the combined movement of the groundwaters and moisture of the zone of aeration. A brief review is offered of the main developments and stages in development of concepts about the free surface movement of subsurface waters. This review includes the Boussinesq equation, direct observations made of the formation of the surface of depression of groundwaters, and the complications imposed by infiltration recharge. An attempt was made to create a generalized model of groundwater movement in the form of a system of equations in which the groundwater flow is described by the Boussinesq equation and moisture transport by the Richards equation. Merger of the models of the movement of groundwaters and moisture of the zone of aeration occurred as a result of the development of a fundamentally different approach to the formulation and solution of problems of free-surface flow, that is, problems of flow in a region bounded by an unknown surface of depression but free from the assumption of vertical averaging of the head. The possibilities of an analytic solution of the problem in such a formulation are limited by the conditions of steady flow in the presence of a sufficiently simple configuration of the region of movement. The solution of the plane profile problem of the combined movement of groundwaters and moisture of the zone of aeration gave rise to a new stage in the development of groundwater dynamics in that the components of the process were unified by a general diffusion-moisture model. (Baker-FRC)
W83-03542

AN IMPROVED UNDERSTANDING OF FLOW IN A LIMESTONE AQUIFER USING FIELD EVIDENCE AND MATHEMATICAL MODELS,
Birmingham Univ. (England). Dept. of Civil Engineering.
K. R. Rushton, E. J. Smith, and L. M. Tomlinson.
Journal of the Institution of Water Engineers and Scientists, Vol 36, No 5, p 369-387, September, 1982. 10 Fig, 1 Tab, 13 Ref.

Descriptors: *Aquifer characteristics, *Model studies, *Flow characteristics, Hydraulics, Fluid mechanics, Mathematical studies, Limestone, *England, Southern Lincolnshire Limestone aquifer.

A long-term study of the Southern Lincolnshire Limestone aquifer is described. An understanding of the flow processes within the aquifer was gained from an interplay between field evidence and a mathematical model of the aquifer. A drought occurring in 1976 followed by the very wet winter of 1976-1977 provided valuable information, which means that the mathematical model can be used with confidence to predict aquifer behavior in times of high and low flows. Water balances for the confined region illustrate the interaction between the various inflows and outflows. Particular features which have been important in the 10 year study for this aquifer include: transmissivity and storage coefficient that vary with saturated depth; rapid recharge via swallow holes to the confined region; recharge which is sometimes less than the potential value due to the inability of the aquifer to accept more water; springs which are functions of the groundwater head and are influenced by varying transmissivities; and no net inflow of poor quality connate water from the east. The general approach used in this study is applicable to other aquifers in which the primary mechanism is that recharge occurs in the outcrop region and the water then moves down-dip to the confined region, where major abstraction occurs. However, each aquifer has its own individual features which can only be identified by a detailed field and mathematical model study. (Baker-FRC)
W83-03578

INJECTION AND THERMAL BREAKTHROUGH IN FRACTURED GEOTHERMAL RESERVOIRS,
California Univ., Berkeley. Lawrence Berkeley Lab.
G. S. Bodvarsson, and C. F. Tsang.
Journal of Geophysical Research, Vol 87, No B2, p 1031-1048, February 10, 1982. 30 Fig, 3 Tab, 44 Ref.

Descriptors: *Geothermal studies, *Injection wells, *Groundwater movement, Geologic fractures, Wells, Model studies, Heat flow, Thermal water, Fluid flow.

Cold water injected into a fractured geothermal reservoir will advance along the fractures, gradually extract heat from the adjacent rock matrix, and eventually arrive at the production wells, possibly reducing energy output due to decreasing fluid enthalpies. To predict this possibility, a model was developed for an injection well fully penetrating a fractured geothermal reservoir containing equally spaced horizontal fractures. A constant temperature liquid water is injected into the fractures; the rock matrix is assumed to be impermeable, and the effect of heat conduction on the cold water advancing along the fractures is observed. Type curves were generated for determining the appropriate flow rates and locations of the injection wells in designing injection/production systems. Temperature contour maps were developed to estimate the amount of energy recoverable from the geothermal system, based on a given injection/production scheme. Two simple numerical examples using a hypothetical doublet and the Cerro Prieto geological model are given. Calculations indicate that at typical injection rates in this model the thermal front will have advanced only 240 m away from the injection well after 30 yr of injection. The estimate is independent of fractures in the reservoirs. (Cassar-FRC)
W83-03585

STUDIES IN DYE-TRACING TECHNIQUES AND KARST HYDROGEOLOGY,
Kentucky Water Resources Research Inst., Lexington.
For primary bibliographic entry see Field 5B.
W83-03599

ESTIMATING MIXING IN AQUIFERS BY TEMPERATURE DISTRIBUTION,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
E. S. Simpson, and D. M. McEligot.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-235473, Price codes: A02 in paper copy, A01 in microfiche. Water Resources Center Completion Report, Tucson, June 1983. 12 p, 2 Fig, 1 Tab, 7 Ref. OWRT A-060-ARIZ(1), 14-31-0001-5003.

Descriptors: Groundwater, *Groundwater dispersion, *Groundwater temperature, Tucson Basin aquifer, *Arizona, *Aquifer, Mixing, *Temperature distribution, Transverse dispersion.

The upper portion of the Tucson Basin aquifer consists of highly transmissive alluvial deposits. Using available measurements of the local geothermal heat flux and a conservative estimate of the coefficient of thermal conductivity of a saturated alluvium, it is found that the calculated temperature gradient due to conduction is nearly twice steeper than the actual temperature gradient measured in wells. Based on the hypothesis that the difference results from convection by random vertical components of average horizontal groundwater velocity, a relationship is developed, using reasoning similar to a development of Reynolds' analogy applied to convective heat transfer in turbulent nonporous flow, that relates random velocities in groundwater flow to convective heat transport. It is further assumed that this convective component for heat transport is related to the transverse (vertical) mixing characteristic of the aquifer for the transport of dissolved species. According to the method developed in this paper, the coefficient of transverse dispersion in the Tucson aquifer is on the order of 400 cm super 2 /day. Assuming a typical seepage velocity of 24 cm/day, the transverse dispersity is 16 cm.
W83-03605

GEOPHYSICAL MAPPING TECHNIQUES FOR GROUNDWATER AVAILABILITY, CENTRAL PIEDMONT PROVINCE, NORTH CAROLINA,
Guilford Coll., Greensboro, NC. Dept. of Geology and Earth Sciences.
For primary bibliographic entry see Field 3B.
W83-03612

SOURCE PROTECTION - AN OUNCE OF PREVENTION,
Dufresne-Henry, Inc., North Springfield, VT. Solid Waste Dept.
For primary bibliographic entry see Field 5G.
W83-03627

MEASUREMENT, PREDICTION, AND HAZARD EVALUATION OF EARTH FISSURING AND SUBSIDENCE DUE TO GROUNDWATER OVERDRAFT,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
S. N. Davis.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-243071, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Research Center Completion Report, Tucson, Ariz., June 1983. 44 p, 12 Fig, 29 Ref. B-092-ARIZ(1), 14-34-0001-0258.

Descriptors: *Geologic fractures, *Subsidence, Groundwater, Overdraft, Groundwater pollution, Prediction, *Arizona, *Fissures, Hazard evaluation, Gullies.

Earth fissuring associated with subsidence which, in turn, is induced by over-extraction of ground water was studied at several localities in central and southeastern Arizona. Work included detailed mapping of fissures and associated gullies, precise measurements of changes of apertures of fissures, runoff intercepted by fissures, randon emissions associated with areas of fissuring and subsidence, and gravity anomalies related to fissuring. The most basic hydrogeologic controls of fissure development appear to be a combination of differntial compaction of alluvium overlying bedrock irregularities and the desiccation of sediments. The locations of larger fissures which are elongate are determined by bedrock configurations. Fissures having polygonal patterns are probably caused in most places by dessiccation. The desiccation is induced by natural climatic fluctuations as well as by the lowering of ground-water levels. Of the various study techniques used, the most information was obtained from runoff, erosion, and sedimentation measurements. Based on the volume of sediment washed into fissures, total depths of fissures of between 50 and 100 meters appear common. Gullies which feed water into earth fissures develop rapidly in response to only one or two runoff events. These side gullies together with the erosion-enlarged fissures present major hazards to range stock and vehicular traffic on roads and railroads which cross the fissures.
W83-03668

MINERALOGICAL MODEL OF THE FLORIDAN AQUIFER IN THE SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT,
Florida Water Resources Research Center, Gainesville.
A. F. Randazzo.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-243097, Price codes: A04 in paper copy, A01 in microfiche. Publication No 68, May 1983. 48 p, 14 Fig, 2 Tab, 74 Ref. OWRT B-042-FLA(1), 14-34-0001-0214.

Descriptors: *Groundwater movement, Porosity, Permeability, Groundwater resources, Aquifer management, Limestones, Petrography, Water management, *Aquifers, *Mineralogy, *Diagnesis, *Florida, Geochemistry, Dolomite, Floridan aquifer.

Distribution of geological and hydrochemical parameters in cores and wells penetrating the Floridan aquifer along the west coast of peninsular

Florida is related to the occurrence of dolomite. Trace element analyses of the cores indicate correlations between strontium and sodium concentrations and the particular carbonate phase. Chloride, sulfate, and conductivity values indicate the position and extent of the freshwater-saltwater interface. Thick sequences of carbonate rocks in western peninsula Florida have been dolomitized in the freshwater-saltwater mixing zone. A multivariate computer analyses revealed several trends of environment of deposition parameters. Energy levels and faunal diversities helped to reconstruct the paleoenvironments of these Tertiary carbonate rocks which were coordinated with the stratigraphy of the study area. Correlations between the occurrence of dolomite and specific stratigraphic formations suggest that dolomitization was rock-selective. Evidence of continuous formation of dolomite indicates that the process is actively occurring. The nature and distribution of dolomite has affected porosity. Mineral dissolution and replacement affects groundwater movement. Understanding these interactions will aid hydrologists to inventory more precisely present-day water supplies and to achieve more efficient water management by integrating the mineralogical model with hydrologic data.
W83-03670

A FINITE ELEMENT MODEL TO PREDICT THE FLOW OF UNDERGROUND CONTAMINANTS DUE TO LEAKAGE OF CHEMICAL AND/OR RADIOACTIVE MATERIAL FROM A BURIED CONTAINMENT,
Clemson Univ., SC. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W83-03672

WATER BALANCE OF THE PEARL HARBOR-HONOLULU BASIN, HAWAII, 1946-1975,
Hawaii Univ. at Manoa, Honolulu. Water Resources Research Center.
For primary bibliographic entry see Field 4B.
W83-03673

STABLE ISOTOPIC INVESTIGATION OF THE GROUND WATER QUALITY AND TRANSPORT SYSTEMS IN THE SAFFORD VALLEY, ARIZONA,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
For primary bibliographic entry see Field 2K.
W83-03674

WATER CONSERVATION AND GROUNDWATER RECHARGE ON EASTERN LONG ISLAND,
New York State Coll. of Agriculture and Life Sciences, Ithaca. Dept. of Agricultural Engineering.
T. S. Steenhuis, C. Jackson, S. Kung, W. H. Brutsaert, and S. V. Cary.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-246520, Price codes: A03 in paper copy, A01 in microfiche. Center for Environmental Research Completion Report, Ithaca, NY, June 1983. 39 p, 9 Fig, 6 Tab, 28 Ref. OWRT B-099-NY(1), 14-34-0001-0236.

Descriptors: *Recharge, *Hydrologic budget, *Evaporation, *Evapotranspiration, *Long Island, *Hydrologic cycle, *Groundwater recharge, *Vadosewater, *Unsaturated flow, Estimating, Heat budget, Heat balance, Meteorology, Soil water, *New York, *Water conservation.

Two methods were tested for their suitability to provide improved estimates of recharge in eastern Long Island: measuring recharge with a direct application of Darcy's Law, and calculating recharge from the hydrologic budget equation with evaporation computed from micrometeorologic data. It was found that the recharge figure, now in general use, of 50% of the annul precipitation is a long-term average at best. Our measurements of recharge performed over a three-year period showed that the vertical flux past the 1 m depth was strongly dependent on both time of year and precipitation amount. In late fall, winter and early spring a high percentage of precipitation became recharge. During the summer months there was a small net upward movement of water past the 1m depth; precipitation did not contribute to the annual recharge. It may be concluded from our measurements that in order to estimate recharge special attention should be given to precipitation during the winter months. A better estimate for annual recharge than the current 50% of annual precipitation might be to take approximately 90%of the precipitation from October 15 until May 15. The two methods used for estimating recharge were labor intensive and required experienced technicians. Currently, one method cannot be recommended above the other. Both methods give a good estimate during the year except for the winter. More research is needed to determine why both methods deviated during the winter.
W83-03703

A STUDY OF RADIUM-226 AND RADON-222 CONCENTRATION IN GROUND WATER NEAR A PHOSPHATE MINING AND MANUFACTURING FACILITY WITH EMPHASIS ON THE HYDROGEOLOGIC CHARACTERISTICS OF THE AREA,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
For primary bibliographic entry see Field 5B.
W83-03714

GROUND WATER YIELDS AND AVAILABILITY IN FRACTURED CRYSTALLINE ROCKS, WAKE COUNTY, NORTH CAROLINA,
North Carolina State Univ. at Raleigh. Dept. of Marine, Earth and Atmospheric Sciences.
T. M. Wilson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-248351, Price codes: A05 in paper copy, A01 in microfiche. M.S. Thesis, 1982. 89 p, 7 Fig, 8 Tab, 32 Ref, 6 Maps. OWRT A-120-NC, 14-34-0001-1135.

Descriptors: *Groundwater, *Geohydrology, *Groundwater availability, *Well yield, Specific capacity, Crystalline rocks, Aquifers, Petrology, Geologic fractures, Topography, Groundwater potential, Groundwater movement, Low flow, Streams, Base flow, Recharge, Well data, Well hydraulics, Pumping tests, *North Carolina, Wake County.

The research investigates the effect of hydrogeologic factors on well yields and the distribution of ground water resources in the fractured crystalline rock aquifers of Wake County, N.C. The characteristics of the fracture system are the most important factors affecting well yield. Lithology is the second most significant variable affecting yield. Topography and saprolite thickness appear to be more significant to well yields than wellsite elevation or distance of well to nearest draw. Mean yields ranged from 45 gpm for wells located in the injected gneiss and schist to 21 gpm for wells located in the injected mica and hornblende gneiss and schist. Unlike most porous, granular aquifers, well yield and specific capacity in fractured crystalline rocks decrease with well depth. A multiple linear regression analysis failed to account for a significant amount of the variation in specific capacity. This failure is believed to be caused primarily by the exclusion of a measure of wellsite fracture characteristics from the model. Several indirect methods were studied to characterize the fracture systems. The Jenkins and Prentice (1982) equation of linear flow appears to be an appropriate method for determining characteristics of a fractured crystalline aquifer. Low flow stream characteristics can also be used to indirectly locate intensely fractured areas and determine relative ground water availability.
W83-03733

CALCULATIONS OF SEEPAGE LOSSES OF WATER BODIES UNDER THE EFFECT OF INFILTRATION INTAKES,
Central Scientific-Research Inst. of Multipurpose Use of Water Resources (USSR).
V. A. Zlotnik, and M. G. Murashko.
Water Resources (English Translation), Vol 9, No 2, p 172-176, March-April, 1982. 1 Fig, 1 Tab, 9 Ref. Translated from Vodnye Resursy, No 2, p 83-88, March-April, 1982.

Descriptors: *Seepage loss, *Aquifers, *Infiltration, Safe yield, Mathematical equations, Mathematical studies, Water storage, Wastewater storage.

Intense and prolonged exploitation of groundwaters leads to the formation of cones of depression having a considerable area. Recharge of water bodies in the presence of a hydraulic connection with aquifers is reduced or replaced by discharge. When estimating the safe yield of infiltration (bank) intakes it is necessary to calculate seepage losses and the drop in the level of surface water bodies, which are determined by the groundwater seepage regime in the zone adjacent to the water body, shape of the water bodies in plan, character of their incision into the exploited bed, degree of siltation of the bottom and banks, and location of the tapping structures. Analogous calculations are necessary when designing infiltration basins and vertical drainage for protecting groundwaters from pollution in the case of spills from industrial wastewater and sludge storage points. Fully penetrating water bodies having a good hydraulic connection with aquifers are a prevalent type. A method is given for calculating seepage losses and drop of the water level in round water bodies when estimating the safe yield of groundwaters for infiltration intakes. (Baker-FRC)
W83-03757

NUMERICAL MODELING OF GROUNDWATER FLOW PROCESSES,
Leningrad Mining Inst. (USSR).
E. A. Lomakin, and V. A. Mironenko.
Water Resources (English Translation), Vol 9, No 2, p 149-157, March-April, 1982. 6 Fig, 30 Ref. Translated from Vodnye Resursy, No 2, p 53-63, March-April, 1982.

Descriptors: *Groundwater movement, *Model studies, Computers, Mathematical models, Groundwater, Flow, Groundwater management, Water supply.

At present, modeling of groundwater flow processes on analog computers is used as an effective method of solving various problems, mainly of a predictive character. A review of current reports indicates an urgent need for developing definite, sufficiently standard criteria which permit an evaluation of various methods and schemes of mathematical modeling of groundwater flow problems. Such criteria based on a theoretical study of the problem and comprehensive analysis of test material should at the same time reflect the specific characteristics of groundwater flow problems. An effective method of mathematical modeling should be viewed in terms of the subjective factors of the simplicity and physical tangibility of the mathematical bases of the method, the availability of technical means of realizing the method, and universality. Also of significance are stability, optimality, possibility of realization and reliability. At present the most promising direction of mathematical modeling of groundwater flow processes should be associated with the wide introduction of numerical methods. One of the most efficient methods for solving linear groundwater flow problems is the alternating direction implicit method in its integro-balance modification. However, for providing conditions of reliability in the practical realization of this method it is necessary to introduce certain constraints on the selection of the time step, which are approximately reflected, for example, by the criterion that the number of time intervals is greater than 5 times K, where K is equal to the pressure capacity times the time step divided by the square of the space step. (Baker-FRC)
W83-03771

2G. Water In Soils

COMBINED MOVEMENT OF GROUNDWATERS AND MOISTURE OF THE ZONE OF AERATION,

Vsesoyuznyi Nauchno-Issledovatel'skii Inst. Gidrogeologii i Inzhenerdoi Geologii, Moscow (USSR).
For primary bibliographic entry see Field 2F.
W83-03542

PREDICTING INFILTRATION AND SURFACE RUNOFF FROM RECONSTRUCTED SPOILS AND SOILS,
Kentucky Water Resources Research Inst., Lexington.
For primary bibliographic entry see Field 4C.
W83-03610

TWO-DIMENSIONAL EXPONENTIAL INFILTRATION EQUATIONS,
Y. S. Fok, S. O. Chung, and C. C. K. Liu.
Journal of the Irrigation and Drainage Division, Proceedings of the American Society of Civil Engineers, Vol 108, No IR4, p 231-241, December, 1982. 5 Fig, 3 Tab, 13 Ref.

Descriptors: *Infiltration rate, *Wetting, *Irrigation design, Soil water, Irrigation systems, Soil moisture, Equations.

Physical two-dimensional infiltration, important in the design of furrow and drip irrigation systems, was expressed in exponential form by using the vertical and horizontal one-dimensional infiltration equation. It was also assumed that the loci of the wetting patterns for the two-dimensional infiltration are half-ellipses. The equations were evaluated using the soil box method at two soil moisture levels, dry and wetter, using clay loams. For the dry soil moisture level the calculated and observed infiltration rates were in good agreement, within 11%. However, at the wetter soil moisture level the predicted infiltration rates were up to 56% less than observed rates during the first 150 min of infiltration time and up to 14% more during the 150-330 min period. Considering the small arithematic differences between computed and observed accumulative infiltration rates the two values agreed well. Discrepancies were attributed to assumptions made in derivation of the equations, namely, anisotropy and a reduction in vertical hydraulic conductivity with respect to horizontal conductivity. (Cassar-FRC)
W83-03663

DISPOSAL OF HOUSEHOLD WASTEWATER IN SOILS OF HIGH STONE CONTENT,
Arkansas Univ., Fayetteville. Dept. of Agronomy.
For primary bibliographic entry see Field 5D.
W83-03679

MOVEMENT OF BACTERIA THROUGH MACROPORES TO GROUND WATER,
Kentucky Water Resources Research Inst., Lexington.
For primary bibliographic entry see Field 5B.
W83-03705

A REVIEW OF THE USE OF DYES AS SOIL WATER TRACERS,
Soil and Irrigation Research Inst., Pretoria (South Africa). Dept. of Agriculture and Fisheries.
M. J. McLaughlin.
Water SA, Vol 8, No 4, p 196-201, 1982. 5 Fig, 43 Ref.

Descriptors: *Soil water, *Tracers, Environmental tracers, Flow, *Dye release, Dyes, Chemical properties, Chemical interference, Adsorption, Sulfonates, Fluorometry, *Reviews.

The suitability of dyes as soil water tracers is discussed in the light of recent findings. Nonfluorescent dyes are suitable for some applications because they are relatively stable in soil and are inexpensive to use. Fluorescent dyes have the advantage that they are detectable at lower concentrations, but different dyes vary in their susceptability to environmental conditions. No one dye is suitable for all applications. Also, because most of the dyes studied are large molecules, they will be adsorbed to a certain extent by all soils, even if electrostatically uncharged. Although these adsorbed dyes can indicate pathways of flow, they provide little information of the distribution and residence time of water in soil. As yet no dyes have been developed which follow exactly the movement of water in soil. It appears that tracer dyes which perform well as water tracers possess more than one sulfonic acid group, an observation which holds for both fluorescent and non-fluorescent dye types. Compared to other types of tracers such as salts, radioisotopes and biological tracers, tracer dyes appear to offer great potential for simultaneously relating solute distribution in soils to soil physical and morphological characteristics. Parts of the profile active in water movement can be identified without destroying soil structure, thereby enabling valuable soil physical information to be obtained simultaneously with tracer distribution data. (Baker-FRC)
W83-03736

HYDRODYNAMIC DISPERSION INVOLVING CATIONIC ADSORPTION DURING UNSATURATED, TRANSIENT WATER FLOW IN SOIL,
Guelph Univ. (Ontario). Dept. of Land Resource Science.
K. B. Laryea, D. E. Elrick, and M. J. L. Robin.
Soil Science Society of America Journal, Vol 46, No 4, p 667-671, July/August, 1982. 4 Fig, 1 Tab, 12 Ref.

Descriptors: *Soil water, Flow, *Solute transport, *Potassium chloride, Chlorides, Salts, Soil properties, Leaching, Infiltration, Permeability, *Transient flow, *Dispersion.

The movement of potassium chloride during the horizontal infiltration of a KCl solution into a semi-infinite soil column of constant initial volumetric moisture content and constant initial salt concentration is described. The soil had been Ca2+ saturated and washed free of salts. The exchange process involved is assumed to be instantaneous and is described by a nonlinear adsorption isotherm. The relevant equations are solved for the apparent longitudinal dispersion coefficient using a computer program written in system/360 CSMP. Experiments performed with a clay loam soil indicate that an apparent longitudinal dispersion function for solutes which interact with the soil matrix may be described by the conventional dispersion equation if it is assumed that because of the usually very low flow velocities in natural soils, the dispersion coefficient is effectively velocity independent. (Baker-FRC)
W83-03749

PERCHED WATER TABLES ON HILLSIDES IN WESTERN OREGON: II. PREFERENTIAL DOWNSLOPE MOVEMENT OF WATER AND ANIONS,
Oregon State Univ., Corvallis. Agricultural Experiment Station.
D. P. Hammermeister, G. F. Kling, and J. A. Vomocil.
Soil Science Society of America Journal, Vol 46, No 4, p 819-826, July/August, 1982. 2 Fig, 4 Tab, 19 Ref.

Descriptors: *Perched water table, *Pores, *Permeability, Macropores, Interstitial water, Soil solution, Anions, Pore velocity, Soil chemistry, Environmental tracers, *Oregon.

Data concerning the movement and halide tracer ions in sloping perched water tables are presented. Halide ion tracers were introduced into line sources at each site of the study during at least two rainstorms in the winter of 1976. Evidence indicates that preferential flow occurred at experimental sites on three hillsides on the border of the Willamette Valley in western Oregon. During saturated flow the very high maximum rates of halide ion movement coupled with both the high concentrations of halide anions when first detected and the rapid movement of anions in directions not predicted from hydraulic gradients and pore velocity vectors suggest that water and solute flow preferentially through large continuous voids. The highly variable pattern of anion movement during saturated flow also points to the preferential nature of water and solute flow. The voids apparently interconnect the A, B, and C horizons and lower depths. The results of experiments conducted in several unsaturated soils during heavy rainfall indicate that preferential flow may occur through continuous macropores, even though the surrounding soil mass is unsaturated. Finally, dye experiments showed a variety of channels and cracks which preferentially conduct dye and water. These continuous macropores ranged in size from about 10 cm down to several tenths of a millimeter. These voids include rodent holes, channels around living roots, crotovinas, cracks between soil peds, and cracks in the underlying lithic and paralithic rocks. (Baker-FRC)
W83-03751

MEASURING THE HYDRAULIC CONDUCTIVITY OF SOIL HORIZONS WITH CONTINUOUS MACROPORES,
Stichting voor Bodemkartering, Wageningen (Netherlands).
J. Bouma.
Soil Science Society of America Journal, Vol 46, No 2, p 438-441, March/April, 1982. 2 Fig, 17 Ref.

Descriptors: *Hydraulic conductivity, *Soil water, Permeability, Infiltration, Unsaturated flow, Saturated flow, *Macropores, Porosity, Soil characteristics, *Netherlands, Soil horizons.

Field data for two soils in the Netherlands were used to study problems arising when interpreting K measurements for saturated soil horizons with continuous macropores. The problems studied were, first, that measured fluxes in a particular soil horizon have different values when the horizon is considered separately or when it is attached to either the underlying or to both the underlying and overlying horizons; and secondly, the fact that fluxes have a wide range of values at saturation, even when measured in one sample within a limited period of time, when infiltration occurs through different light surface crusts. The range of fluxes noted was particularly large for the B21g horizon, which has large vertical worm channels. They conduct much water when they are continous throughout the sample in detached columns. Very light crusts do not induce unsaturated conditions in the subcrust soil. The various examples considered illustrate that flow of water through bi-porous media is difficult to characterize. If feasible, the flow system through the macropores should be separated from the one through the soil matrix. Distinction of a K-sat value for the entire soil, including the macropores, and a K-sat for only the matrix can be helpful for describing the flow system. Of course the concept of K-unsat remains unchanged in terms of a flux at negative pressure heads in the soil matrix. (Baker-FRC)
W83-03754

HEAVY WATER TRACING OF SOIL-WATER TRANSFERS UNDER IRRIGATION,
CEA Centre d'Etudes Nucleaires de Cadarache, Saint-Paul-les-Durance (France). Service de Radio-Agronomie.
P. Moutonnet, and P. Couchat.
Soil Science Society of America Journal, Vol 46, No 2, p 435-438, March/April, 1982. 6 Fig, 6 Ref.

Descriptors: *Irrigation, *Soil water, Permeability, Infiltration, Irrigation programs, Crop yield, Fertilization, Solute transport, Corn.

A laboratory study is reported in which the movement of an added pulse of deuterated water was monitored in a soil column containing maize. Water inputs were automatically controlled by an irrigation device based on soil-water potential measurements made at two different depths in the root zone. The results were analyzed from the standpoint of normal and heavy water balances and of water transfers in soil. Based on the findings of two consecutive experiments, water and heavy water balance and water transfer analysis, the system was found to provide fully satisfactory irrigation. Deuterated water labeling, moreover, proved to be an effective technique for evaluating root uptake in a soil horizon. Molecular diffusion

of deuterium in the soil solution was negligible over the experimental time period, and the gravitational potential results in a downward displacement of the labeled water pulse. (Baker-FRC)
W83-03755

PERCHED WATER TABLES ON HILLSIDES IN WESTERN OREGON: I. SOME FACTORS AFFECTING THEIR DEVELOPMENT AND LONGEVITY,
Oregon State Univ., Corvallis. Agricultural Experiment Station.
D. P. Hammermeister, G. F. Kling, and J. A. Vomocil.
Soil Science Society of America Journal, Vol 46, No 4, p 811-818, July/August, 1982. 4 Fig, 6 Tab, 19 Ref.

Descriptors: *Perched water table, *Permeability coefficient, *Soil water potential, Pressure, Water table, Perched water, Runoff, Oregon, Rainfall-runoff relationships, *Oregon.

Some factors affecting the development and longevity of perched water tables in response to rainfall are examined. Study plots were located on hillsides on the edge of the Willamette Valley in western Oregon. Plots of soil water pressure potentials and rainfall vs time for sites in upper convex slope positions on two hillsides show that impermeable regions of rock are more effective in creating and maintaining zones of saturation. Plots of soil water pressure potentials and rainfall vs time and the calculation of hydraulic gradients for sites located at both upper and lower convex slope positions on these hillslopes suggests that subsurface flow contributes water lower slope positions and is an important factor in determining the longevity of perched water tables. A comparison of the development and maintenance of perched water tables on a lower concave region of slope with upper convex regions of slope shows major differences. Perched water tables last longer in the upper horizons in the lower concave region of slope due to the presence of an impermeable lower B and C horizon and the contribution of subsurface flow from upslope regions of hillside. Perched water tables in the A and B horizons in the lower region developed more rapidly, probably mainly from the infiltration of rainfall to a perched water table already present in the C horizon. However, preferential subsurface flow may also make a contribution to their rapid development. Finally, perched water tables did not form in the upper horizons of a hillside where both the soil and upper rock mantle were highly permeable. (Baker-FRC)
W83-03768

SALT STATUS OF GLACIAL TILL SOILS OF NORTH-CENTRAL MONTANA AS AFFECTED BY THE CROP-FALLOW SYSTEM OF DRYLAND FARMING,
Montana Agricultural Experiment Station, Bozeman.
H. Ferguson, and T. Bateridge.
Soil Science Society of America Journal, Vol 46, No 4, p 807-810, July/August, 1982. 3 Tab, 23 Ref.

Descriptors: *Dry farming, *Groundwater contamination, *Salinity, Leaching, Water quality, Saline seeps, *Montana.

Efforts were made to determine whether measurable quantities of soluble salts have been removed from soils subjected to crop-fallow farming compared to native grassland areas. Findings indicate that crop-fallow farming has caused significant leaching of salts under semiarid conditions. It also indicates that apparently beneficial activities of man can have conflicting long-term consequences. The crop-fallow system stabilized agricultural production in the northern and central Great Plains because of increased water storage in the root zone. It improved the edaphological properties of these young soils through removal of salts by leaching from the root zone. However, the large amount of salts removed from the soil in the recharge areas has resulted in salinization of groundwater and the development of saline seeps. (Baker-FRC)
W83-03769

SOYBEAN RESPONSES TO IRRIGATION AND TILLAGE ON A COMPACTED COASTAL PLAINS SOIL,
Clemson Univ., SC. Dept. of Agronomy and Soils.
For primary bibliographic entry see Field 2I.
W83-03774

TRICKLE IRRIGATION - MODELING WATER AND SOLUTES,
Arizona Univ., Tucson. Dept. of Mathematics.
D. O. Lomen, and A. W. Warrick.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-249680, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Research Center Completion Report, April 1983. 63 p, 12 Fig, 3 Tab, 59 Ref. OWRT B-097(1), 14-34-0001-1203.

Descriptors: Richards' equation, Unsaturated soil, *Soil water, *Trickle irrigation, *Solute movement, Plant uptake, *Infiltration, Saline water, *Soil-water-plant relationships.

This research addresses the problem of water and salt distribution for geometries appropriate for trickle irrigation. The results of exact solutins of mathematical models for infiltration from point, disc and line sources were put in the form of nomographs. This allows the user to see the relationships between discharge rate, plant uptake and soil water potential at a reference point. The soil characteristics are given by values of K sub o and a in the equation K = K sub o exp (oh), relating the unsaturated hydraulic conductivity to the pressure head. Another analysis using this hydraulic conductivity function described a two-dimensional situation with a rectangular source or sink. The form of this solution allows the user to approximate any explicitly defined root extraction pattern by superimposing several rectangles. A generalized solution was obtained for one-dimensional infiltration using hydraulic functions of Brooks and Corey. Here the results were presented in a 6x20 table which, in principle, allows finding moisture profiles, wetting front, intake rate and cumulative intake for all times, all soils and varying initial water contents. In principle, the method can be used also for multidimensional systems. An analytical solution was developed for one-dimensional salt and water transport in soil systems with a steady intake velocity. Both water and solutes are non-conservative in the sense that they are removed by plant roots. The unique feature of the solution is the coupling of the unsaturated flow to solute uptake by the use of a 'reflection coefficient' describing selective uptake by roots.
W83-03777

CALCULATING THE DEPTHS OF SOIL MOISTURE CONTROL SECTIONS FROM LABORATORY DATA,
Ohio Agricultural Research and Development Center, Wooster.
T. M. Zobeck, and L. A. Daugherty.
Soil Science Society of America Journal, Vol 46, No 4, p 792-895, July/August, 1982. 1 Fig, 4 Tab, 25 Ref.

Descriptors: *Soil water, *Water retention, Mathematical equations, Soil moisture retention, Available water.

Calculations were made of the upper and lower boundaries of a soil moisture control section. These calculations are illustrated using only the depth, bulk density, and saturated, -1/3, and/or -15 bar water contents plus the amount of coarse fragments of the soil horizons. The initial water content of the soil and the final water content after infiltration are extremely important in calculating the depth to which water will penetrate. The amount of water that a soil can retain is equal to the difference between the final and initial moisture contents of a soil throughout the depth of penetration. The results of the analysis suggest that a reasonable estimate of the -60 cm water content can be made knowing only the saturated, -1/3 bar and/or -15 bar water contents. Any one of the water content values can be used alone or in combination with another value for slightly higher reliability to predict -60 cm water contents. Addition of any or all of the other soil characteristics studied to the correlation analysis did not significantly improve the regression. It is recommended that the difference between the -50 to -100 cm and -15 bar water contents be used for determining and defining the soil moisture control section in medium to fine-textured soils. Both moisture contents are reasonable approximations of physically or biologically significant moisture levels and easily determined in the laboratory. The definition would then correspond to the familiar available water-holding capacity (AWC) value currently in use. (Baker-FRC)
W83-03780

FIELD VS. LABORATORY DETERMINED HYDRAULIC CONDUCTIVITIES OF SOME SLOWLY PERMEABLE HORIZONS,
Soil Conservation Service, Gainesville, FL.
F. C. Watts, H. F. Huckle, and R. F. Paetzold.
Soil Science Society of America Journal, Vol 46, No 4, p 782-784, July/August, 1982. 5 Tab, 15 Ref.

Descriptors: *Permeability coefficient, *Soil water, Leaching, Infiltration, Piezometry, Soil types, Field tests, Laboratory studies, Mathematical studies.

A comparison was made between saturated hydraulic conductivity values obtained from the piezometer method and results of the laboratory core method for several soils in the flatwoods region of southeast Florida. The piezometer method was used to measure saturated hydraulic conductivities of spodic and argillic horizons in 15 soils. Textures of argillic horizons in these soils range from sandy loam to sandy clay loam. Spodic horizons in these soils range from sand to loamy sand. There was very poor correlation between hydraulic conductivity values derived from core measurements and those obtained with the piezometer method. This suggests the presence of random variation in addition to the obvious bias. Spodic horizons, based on core data, were placed in moderate and moderately rapid classes except for the Ankona, which was placed in the moderately slow class. Results of the piezometer method indicate that all should be in the very slow class except the Myakka and Pendarvis, which should be classified as moderate and moderately slow, respectively. While a general trend was noted among argillic horizons, the individual data points were widely scattered, and the correlation between hydraulic conductivity and consistence is poor. It was concluded that the core method of measuring saturated hydraulic conductivity consistently gave larger values than the piezometer method. The magnitude of the difference in results obtained using the two methods varied from two to over 700-fold. The core method gave hydraulic conductivity values that are too large when used in the design of water control systems. (Baker-FRC)
W83-03781

CONSTANT-FLUX INFILTRATION FROM A HEMISPHERICAL CAVITY,
Massey Univ., Palmerston North (New Zealand). Dept. of Soil Science.
B. E. Clotheir, and D. R. Scotter.
Soil Science Society of America Journal, Vol 46, No 4, p 696-700, July/August, 1982. 6 Fig, 18 Ref.

Descriptors: *Infiltration, *Soil water, *Mathematical studies, *Fluctuations, Soil moisture availability, Irrigation programs, Trickle irrigation, Water supply, Diffusion.

The process of constant-flux infiltration from a cavity using a method based on the flux-concentration appoach of Philip and Knight is reinvestigated. Other existing theories of three-dimensional infiltration are also studied. The results show that infiltration at 360 ml/hr into a 4 mm radius hemispherical cavity in a repacked fine sand was described quite well by the simple absorption theory for the first 100 min. However, after this time period at this flux, the effects of gravity became evident, as would be expected based on a comparison of the matric and gravitational potential gradients. The nonlinear, steady-stage infiltration theory

of Raats gave reasonable estimates of the water content profiles behind the wet front. The linearized theory of Warrick was of no value in this context. The success of the Raats theory adds some credence to the use in trickle irrigation design of Woodling's theory, which describes infiltration from a circular pond on the basis of the same assumptions. (Baker-FRC)
W83-03782

SOIL PARAMETERS AND SAMPLING SCHEME FOR CHARACTERIZING SOIL HYDRAULIC PROPERTIES OF A WATERSHED,
Hawaii Univ. at Manoa, Honolulu. Water Resources Research Center.
E. Bresler, and R. E. Green.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-253294, Price codes: A03 in paper copy, A01 in microfiche. Technical Report No. 148, December 1982. 42 p, 15 Fig, 5 Tab, 28 Ref. A-094-HI(1), 14-34-0001-2113.

Descriptors: *Hydraulic conductivity, Hydrologic models, *Sampling statistics, Surface-groundwater relationships, Soil water, Watershed(Basins), Monte Carlo method, *Hawaii, *Soil hydraulic indices, *Geostatistics, Saturated conductivity, Drainage-flux method, Kriging, Autocorrelation, Variogram, Spatial variability, Oxisols, Pearl Harbor watershed, Oahu.

Watershed modeling, which incorporates the stochastic nature of the hydraulic properties of the land surface and rainfall, requires a mathematical description of watershed variability, including the frequency distribution of key hydrologic parameters and the spatial structure of variances. Heterogeneous watersheds require extensive sampling to characterize the spatial distribution of a property, such as hydraulic conductivity, which is frequently required as input to model calculations of infiltration and runoff. Since hydraulic conductivity, K, varies with water content, theta, and soil water pressure, h, the K(theta) and K(h) relationships can be conveniently represented by parameters in mathematical expressions relating these variables. The parameters of three different equations are examined as indices of the hydraulic properties of Oxisols soils in Hawaii's Pearl Harbor watershed. When what to measure and how to mathematically express the results is decided, the number and location of field measurement sites in a particular watershed are determined. Geostatistical concepts are applied to design a sampling scheme for a specific watershed in which the measured value of a hydrologic property or index at a given point is correlated with other measured values of the property that is dependent on the distance between sampling points. Required statistical parameters for the geostatistical approach are the mean, variance, and autocorrelation function or variogram. Criteria are specified for selecting the location and smallest possible number of observation points to best estimate the statistical parameters. The results suggest that 30 measurement sites are the minimum sample size for estimating the parameters required for stochastic modeling. The proposed sampling procedure is illustrated with a sampling strategy for a portion of the Pearl Harbor watershed.
W83-03817

2H. Lakes

ENVIRONMENTAL LIMITING FACTORS AFFECTING THE GROWTH AND SPREAD OF CHALCALBURNUS TARICHI (PALL. 1881) (PISCES: CYPRINIDAE) IN BURDUR LAKE (DIE UMWELTFAKTOREN, DIE DIE VERBREITUNG UND ENTWICKLUNG VON CHALCALBURNUS TARICHI (PALL. 1881) (PISCES: CYPRINIDAE) IN BURDUR-SEE BEGRENZEN),
Istanbul Univ. (Turkey). Fen Fakultesi.
For primary bibliographic entry see Field 5C.
W83-03543

SILICA IN LAKES: NUTRIENT COMPETITION, EQUILIBRIUM REACTIONS IN SEDIMENT PORE WATERS, AND ROLE IN METAL CYCLING,
Wisconsin Univ.-Madison. Dept. of Water Chemistry.
D. E. Armstrong, M. A. Anderson, M. L. Machesky, N. Peterson-Holm, and M. Shafer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-246488, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Center Technical Report WIS WRC 83-05, 1983. 48 p, 14 Fig, 12 Tab, 71 Ref. OWRT B-101-WIS(2), 14-34-0001-8128.

Descriptors: *Diatoms, Lakes, *Metals, *Nutrients, *Silica, Algae, Asterionella, Microcystis, Sediments, *Wisconsin, Cyanophta, Dissolved solids, Phosphorus, Aluminum, Iron, Water pollution effects, Pollutant identification, *Growth kinetics, *Algal growth.

The nutrient uptake and growth kinetics of a freshwater diatom (Asterionella formosa) and the blue-green alga (Microcystis aeruginosa) under P or Si limitation were determined in batch culture at 20C. Asterionella had a higher maximum growth rate and a lower half saturation constant for growth than Microcystis under P limitation. The maximum uptake velocity for P was higher for Asterionella than for Microcystis while the half-saturation constants for P uptake were similar for the two species. Concentrations of dissolved silicon, iron and aluminum were measured in the hypolimnetic and sediment pore waters of several Wisconsin lakes representing a range from high to low silicon concentration. Corresponding measurements of pH and temperature were also made. Equilibrium expressions were developed for various Al-Si, Fe-Si, and Fe-Al-Si phases. Required thermodynamic data for the various dissolved species and crystalline and amorphous solids were obtained, and corrections were made for activity and temperature. Predicted concentrations of dissolved species for various solid phases were compared with observed concentrations to evaluate the solid phases apparently controlling dissolved Si, Al, and Fe. Particulate silicon composition and trace metal interactions were investigated in Lake Michigan. During early suummer, diatom silicon represents a high proportion of the suspended particulate matter. The investigation of diatom-metal interactions is continuing.
W83-03699

DIATOMS OF LAKE OF THE OZARKS, MISSOURI,
Missouri Univ.-Columbia. Div. of Biological Sciences.
M. A. Pamperl.
O(7), OWRT-14-34-0001-9027, 0127.

Descriptors: *Diatoms, Periphyton, Phytoplankton, Indicator organisms, Reservoir flora, Sampling, *Missouri, Lake of the Ozarks.

During the summers 1977 and 1978 the diatom communities of Lake of the Ozarks, Missouri were studied. Samples were collected at two-week intervals from six stations located in different regions of the reservoir. Four types of samples were collected at all stations - plankton tows, splash zone and 0.5 m rock scrapings, and scrapings from glass slides placed just below the water's surface. Buoy scrapings were collected at four stations. One hundred fifty-seven diatom taxa were identified from Lake of the Ozarks during the study. Of these taxa, 46 were found to be dominant in at least one of the nearly 300 samples examined. Taxa considered typical of clean water were abundant at stations near Bagnell Dam. Diatoms typical of water rich in nutrients were common at stations farthest from the dam. About one-third of the diatom taxa of Lake of the Ozarks have been reported from other reservoirs in Missouri and bordering states.
W83-03723

SIGNIFICANCE OF FLOODPLAIN SEDIMENTS IN NUTRIENT EXCHANGE BETWEEN A STREAM AND ITS FLOODPLAIN,
East Carolina Univ., Greenville, NC. Dept. of Biology.
M. M. Brinson, D. Bradshaw, and R. N. Holmes.
In: Dynamics of Lotic Ecosystem (Chapter 10), Ann Arbor Science Publishers, Ann Arbor, Mich., 1983. p 199-221, 7 Fig, 1 Tab, 29 Ref. OWRT B-114-NC(3), 14-34-0001-8107.

Descriptors: Streams, *Flood plains, *Swamps, *Sediments, *Cycling nutrients, Lotic environment, Rivers, Overflow, Flood flow, *Nitrogen, *Phosphorus, Nitrate, Ammonium, Phosphate, Sediment-water interfaces, Interstital water, Nitrification, Denitrification, Nitrogen removal, Phosphorus removal, Seasonal variation, Radioactive tracers, *North Carolina, Tar River.

This study describes some of the mechanisms by which nitrogen and phosphorus levels are altered in the surface water of a floodplain swamp and examines how this may ultimately affect concentration of these nutrients in the stream channel during hydrolobic events that drain floodplain water into the stream. A year-long comparison of stream channel and floodplain water of the lower Tar River, North Carolina, established that hydrologic phases resulting in water flow from floodplain to stream channel would dilute nitrate (and usually ammonium) concentrations in stream water. In contrast, floodplain drainage water would normally augment filterable reactive phosphorus in the stream. Seasonal experiments were conducted on sediment-water exchanges of nitrate, ammonium, and phosphate in the floodplain to examine some of the mechanisms responsible for alterations in nutrient concentrations of surface water. Nitrate loss exceeded ammonium loss from surface water to which these ions were added above background levels. Loss rates of both ions were greater in July and November than in February, the coldest month. Nitrogen-15 tracer experiments confirmed a one-way pathway of nitrate from the surface water; this was made possible by denitrification in the sediments. Ammonium diffusion was bidirectional between surface water and sediments. Background concentrations of inorganic nitrogen in interstitial water of surface sediments underwent greatest changes during warm season dry down. Loss of super 32PO4 from surface water was mostly by abiotic mechanisms during all seasons and was entirely so during the coldest part of the year.
W83-03724

HYDROCHEMICAL METHODS OF INVESTIGATING PRODUCTION AND DESTRUCTION PROCESSES IN NATURAL WATERS,
All-Union Research Inst. of Marine Fisheries and Oceanography, Moscow (USSR).
V. V. Sapozhnikov.
Water Resources (English Translation), Vol 9, No 2, p 204-208, March-April, 1982. 5 Fig, 1 Tab, 5 Ref. Translated from Vodnye Resursy, No 2, p 122-128, March-April, 1982.

Descriptors: *Primary productivity, *Measuring instruments, Natural waters, Lakes, Productivity, Aquatic productivity, Dissolved oxygen, Oxygen, Photosynthesis, Acidity, *USSR, Mozhaisk reservoir.

The physiochemical effects of photosynthesis on the pH value and dissolved oxygen are examined for the example of the Mozhaisk reservoir, where a device for automatic recording of dissolved oxygen, pH, water temperature, and underwater illumination has been in operation for six years. In fresh waters, owing to the low buffer action of the water, the changes in pH as a result of photosynthesis are exhibited most clearly. The efficiency of vertical mixing during transport of oxygen downward into colder layers of the reservoir increases as a result of greater solubility of oxygen in waters with a lower temperature. In the Mozhaisk reservoir supersaturation of more than 100% was sometimes noted at depths to 7.0 m. Under conditions of marked stratification of waters on calm days, obviously, such a mechanism of reaeration of waters of the hypolimnion is the dominant one. The effect of inertial oscillations is hardly perceived in the hypolimnion under the thermocline. Automated methods of measuring production and destruction processes have gained special significance recently, when in biohydrochemistry there was a change to

an analysis of processes rather than recording of the end results of their occurrence. A strong temporal variability of production and destruction processes which depends on the variability of external physiochemical conditions was demonstrated. It is concluded that hydrochemical methods are the most effective means of studying production and destruction processes. It was estimated that a string of thermooximeters permits estimating primary production beneath 1 sq m in the entire water column, and continuous recording of oxygen makes it possible to observe the redistribution of dissolved oxygen due to processes of vertical eddy diffusion. Automatic measurements of pH and dissolved oxygen give considerably more correct ideas about the productivity of a water body in situ than bottle determinations of primary production performed by the oxygen or radiocarbon techniques. (Baker-FRC)
W83-03756

VERTICAL DISTRIBUTION OF ZOOPLANKTON IN THE MOLOGA RIVER IN WINTER,
I. K. Riv'yer, S. S. Bakastov, and A. I. Saralov.
Hydrobiological Journal, Vol 17, No 3, p 11-16, 1981. 6 Fig, 8 Ref.

Descriptors: *Vertical distribution, *Zooplankton, Temperature effects, Dissolved oxygen, Oxygen, Water temperature, Rivers, Mologa River, Rybinsk Reservoir, *USSR, Water level, Flow rate, Bacteria, Methane bacteria, Cold regions, Cyclopoida, Rotifers, Reservoirs.

Vertical distribution of zooplankton in a flooded, slow-moving river was studied in February-April 1978 at a station on the Mologa Rive where the river channel is 200 m wide and 14.4-16.5 m deep. During this period the reservoir was being emptied, and by late March the snowmelt water began to arrive. The variations in zooplankton population depended on temperature (0 to 2 C), water level, rate of flow, dissolved oxygen concentration (0 to 10 mg per liter) and distribution of bacteria (1 to 3 million cells per ml). The dominant groups of zooplankton were rotifers and cyclopoids. (Cassar-FRC)
W83-03815

FACTORS CONTROLLING PHYTOPLANKTON IN LAKE VANDA (77 DEGREES S),
Department of Scientific and Industrial Research, Taupo (New Zealand). Ecology Div.
W. F. Vincent, and C. L. Vincent.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 39, No 12, p 1602-1609, December, 1982. 2 Fig, 7 Tab, 26 Ref.

Descriptors: *Phytoplankton, *Photosynthesis, *Nutrients, Lake Vanda, *Antarctica, Lakes, Oligotrophic lakes, Phosphorus, Cold regions, Algae, Iced lakes, Cyanophyta, Flagellates.

Three distinct algal communities were identified in different sections of the water column of permanently ice-covered Lake Vanda, Antarctica, considered the world's clearest and most oligotrophic lake. At the 3.25 m depth Ochromonas miniscula, Polytomella sp. and Chlorella sp. were found. At 30 m the common organisms were Chlorella sp, Chlamydomonas globosa, Phormidium fragile, and P. antarcticum. At 55 m P. antarcticum, P. frigidum, Synechocystis, and P. fragile were present. Microflagellates were predominant in the upper two strata and blue-green algae in the lowest strata. Maximum photosynthesis was at the bottom of the euphotic zone, 55-57.5 m, just above a region of nutrient-rich anoxic water. Two less-pronounced maxima were recorded higher in the water column, one just under the ice and the other at 15-35 m in the center of a large thermohaline convection cell. Phosphorus was very limited, and plankton showed strong P deficiency. Between mid-December and mid-January chlorophyll a levels and cell biomass declined markedly, suggesting that the populations reach maxima early in the season when light is weaker and the Antarctic region is inaccessible to researchers. Temperatures in the bottom layer of the lake reached 18-20 C, characteristic of temperate lakes. (Cassar-FRC)
W83-03838

2I. Water In Plants

THE EFFECT OF EXCESS AND LIMITED SOIL MOISTURE ON NITROGEN FIXATION OF SEVERAL LEGUMINOUS CROPS,
Florida Water Resources Research Center, Gainesville.
J. M. Bennett, and S. L. Albrecht.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-246421, Price codes: A04 in paper copy, A01 in microfiche. Publication No 69, May 1983. 62 p, 28 Fig, 4 Tab, 36 Ref. OWRT A-044-FLA(1), 14-34-0001-1110, 14-34-0001-2110.

Descriptors: Aeschynomene americana, Alfalfa, Bean, Cowpea, Desmodium heterocarpon, *Drought, *Flooding, Leaf water potentials, Soybean, Water relations, *Water stress, Stomatal conductance, *Soil moisture, *Plant growth.

Greenhouse experiments were conducted to examine the effects of flooding and drought on the leaf and nodule water status, stomatal conductance, root respiration and nitrogen fixation of cowpea (Vigna unuiculata L.), alfalfa (Medicago sativa L.), soybean (Glycine max L.), bean (Phaseolus vulgaris L.), Aeschynomene americana, and Desmodium heterocarpon. Soybeans, cowpeas, and Aeschynomene exhibited a tolerance to flooding and the capacity to fix nitrogen in flooded plants remained about the same as the well-watered controls, whereas flooded Desmodium, bean, and alfalfa showed marked reduction in nitrogenase activity with a concommitant decline in plant water status and root respiration. Drought stress resulted in reductions in leaf and nodule water potentials, stomatal conductance, and root respiration as gravimetric soil water content decreased below 1% in the sandy soil medium. In general, nitrogenase activity declined along with other physiological processes, however, there was an indication that nitrogen fixation was more severely inhibited by drought. Rewatering previously drought stressed plants completely restored control levels of the measured physiological parameters.
W83-03687

SOYBEAN RESPONSES TO IRRIGATION AND TILLAGE ON A COMPACTED COASTAL PLAINS SOIL,
Clemson Univ., SC. Dept. of Agronomy and Soils.
V. L. Quisenberry, and H. L. Musen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-248385, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Institute Publication No 111, Clemson Univ., S. C., August 1983. 33 p, 15 Fig, 2 Tab, 19 Ref. OWRT B-110-SC(1), 14-34-001-7186.

Descriptors: Irrigation, Tillage, Water management, Water transport, Soil water, Soil-water-plant relationships, Soil water potential, Soil compaction, *Soybeans, Evapotranspiration, Crop response, Crop yield, *South Carolina.

Two soybean cultivars (Bragg and Ransom, Maturity Groups VII and VIII, respectively) were grown for three years on a Norfolk sand (Typic Paleudult) at Blackville, S. C. Tillage treatments (disked and in-row subsoiling) and irrigation treatments (0.2 bar and no irrigation) were the main plots of a randomized complete block with cultivars the split-plot treatment. For the 3-year average, in-row subsoiling resulted in significantly higher yields than did disking alone. Yields under irrigation were significantly greater than without irrigation. Whereas, subsoiling increased yields under no irrigation, there was no significant difference due to tillage treatments under irrigation. The Norfolk soil usually contains a very compacted zone in the Ap and/or A2 horizon which reduces root development, thereby reducing available water. The data show that by maintaining the soil water pressure greater than 0.2 bar in the upper 60 cm of the profile with irrigation, in-row subsoiling is not necessary. In situ hydraulic conductivity and soil water characteristic curves were measured within the experimental area. From these data, evapotranspiration rates were calculated for each treatment from tensiometer values of soil water pressure. The data show that for maximum yields to be obtained, the ET rate must be equal to or greater than 0.9 open pan evaporation during the reproductive stage of soybean growth.
W83-03774

2J. Erosion and Sedimentation

SOURCES AND FATES OF SEDIMENTARY ORGANIC MATTER IN THE WHITE OAK AND NEUSE RIVER ESTUARIES,
North Carolina Univ. at Chapel Hill. Dept. of Geology.
For primary bibliographic entry see Field 5B.
W83-03590

DISCUSSION: FLOW RESISTANCE IN COARSE GRAVEL BED RIVERS,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 8B.
W83-03644

SIMULATION OF NUTRIENT, MICROORGANISM, AND HEAVY METAL TRANSPORT CAPACITY OF SUSPENDED SEDIMENT,
Arizona Univ., Tucson. School of Renewable Natural Resources.
P. F. Folliott, and W. O. Rasmussen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-248344, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Center Completion Report, Tucson, Ariz., August 1983. 23 p, 3 Fig, 4 Ref, 1 Append. OWRT A-105-ARIZ(4), 14-34-0001-1103.

Descriptors: *Erosion, *Sediments, Nutrients, Heavy metals, *Simulation model, Southwestern U.S., Microorganisms, *Computer programs, Prediction, Water quality control.

SEDCON, a computerized prediction technique (using vegetative and geologic data), which was developed to estimate land management impacts on the physical and chemical characteristics of transported suspended sediment in watersheds of the southwestern United States, is described. A hypothetical example is given to show that, after inputting experimental data or using the default values, estimated values of nutrient (acid digestible and extractable chemicals) and heavy transport capacities of suspended sediment and for (winter or summer) combinations of mixed conifer or ponderosa pine forests and basaltic, granitic, and sedimentary geologies can be displayed.
W83-03732

PARAMETERS FOR DESCRIBING SOIL DETACHMENT DUE TO SINGLE WATERDROP IMPACT,
Purdue Univ., Lafayette, IN. Agricultural Experiment Station.
M. M. Al-Durrah, and J. M. Bradford.
Soil Science Society of America Journal, Vol 46, No 4, p 836-840, July/August, 1982. 2 Fig, 4 Tab, 28 Ref.

Descriptors: *Erosion, *Soil properties, Soil strength, Soil physical properties, Rainfall, Soil erosion, Erosion control.

A simple relationship between soil detachment and single raindrop impact was examined on eight materials having a wide range of particle sizes. For all soils and drop sizes, the weight of soil splash decreased as bulk density increased and matric potential decreased. However, the differences in soil splash weights between three bulk density levels became smaller as the matric potential decreased. A curvilinear relationship was noted between soil splash weight and near-surface shear strength and a relationship dependent on raindrop size. When examining a specific soil, the selection of shear strength as a soil parameter for estimating soil splash was proper. However, the shear strength term does not fully account for differ-

ences in splash weights among soils. Correlating splash weights to the soil properties of sand content, silt content, clay content, texture, organic matter, surface area, pH, soluble salts, CEC, and exchangeable cations plus soil bulk density, matric potential and raindrop energy, without considering the surface shear strength, proved to be unsatisfactory in this study. A maximum coefficient of determination of 0.61 was found from using many combinations of the independent variables in a multiple regression model. This indicates the lack of a direct relationship between the measured soil physical and chemical properties and the actual forces that determine soil detachability. Although the tested splash model using the soil surface shear strength did not full account for differences among soils, it is suggested that the study results show that the concept of a force-resistant type model can be use to predict splash weights. (Baker-FRC)
W83-03750

SURFACE SOIL PHYSICAL PROPERTIES AFTER 36 YEARS OF CROPPING TO WINTER WHEAT,
Texas Agricultural Experiment Station, College Station.
P. W. Unger.
Soil Science Society of America Journal, Vol 46, No 4, p 796-801, July/August 1982. 4 Tab, 19 Ref.

Descriptors: *Soil properties, *Surface drainage, *Erosion, Soil water, Crop yield, *Wheat, Fallow, Tillage, Organic matter, Aggregates, Erosion control.

The effects of long-term practices on dry and water-stable aggregate distribution, OM (organic matter) concentration, modulus of rupture, penetrometer resistance, particle-size distribution, and bulk density of clods of the surface soil were investigated. The field study was conducted on Pullman clay loam. Oneway, sweep, and delayed sweep tillage were used on continuous wheat fallow plots, and oneway and sweep tillage were used on continuous wheat plots. Whether plots of the wheat-fallow system had been cropped to wheat or fallowed during the last wheat season before terminating the study usually had no significant effect on measured soil properties. Although significant differences in soil physical properties or conditions were found due to 36 years of different tillage methods and cropping systems for winter wheat, the differences were relatively small, and no tillage method or cropping system resulted in a condition that seemingly would adversely affect wheat production. In some cases the differences were significantly related to soil organic matter concentration, which after 36 years was higher for sweep than for oneway disk tillage and higher for the continuous wheat than for the wheat-fallow system. No tillage method or cropping system resulted in sufficient large, stable dry aggregrates to effectively control wind erosion, thus pointing to a need to maintain surface residues to aid in controlling erosion. The higher yields with sweep than with oneway tillage and for wheat-fallow than for continuous wheat were apparently related to greater water conservation rather than to any soil physical condition. (Baker-FRC)
W83-03805

ROUTING GRADED SEDIMENTS IN STREAMS: APPLICATIONS,
Tippetts-Abbett-McCarthy-Stratton, New York.
D. K. Borah, C. V. Alonso, and S. N. Prasad.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 108, No HY12, p 1504-1517, December, 1982. 8 Fig, 2 Tab, 18 Ref.

Descriptors: *Sediment transport, Streams, Model studies, River beds, *Sediment grading, Alluvial channels, Armoring, *Colorado, San Luis Valley Canal, *Wyoming, East Fork River.

A one-dimensional numerical model for movement of well-graded sediments through streams was tested with data from two laboratory flumes and two alluvial channel reaches, the San Luis Valley Canal, Colorado, and the East Fork River, Wyoming. The sediment model required the adjustment of only one parameter, the erodibility parameter. The model predicted water and sediment discharges coming out of each reach, size distribution of these transported materials, size distribution of the bed material or the armor coat, and changes in bed elevation. Model predictions agreed reasonably well with the observed data available. (Cassar-FRC)
W83-03832

ROUTING GRADED SEDIMENTS IN STREAMS: FORMULATIONS,
Tippetts-Abbett-McCarthy-Stratton, New York.
D. K. Borah, C. V. Alonso, and S. N. Prasad.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 108, No HY12, p 1486-1503, December, 1982. 4 Fig, 16 Ref.

Descriptors: *Sediment transport, Streams, River beds, Armoring, Model studies, *Sediment grading, Alluvial channels.

The movement of well-graded sediments through a stream network was simulated with a one-dimensional numerical model based on the physical processes governing the mechanics of sediment transport in alluvial channels. This model is suitable for noncohesive materials, relatively stable channel geometrics, streams with negligible out-of-bank transport, and flows without transverse currents. It recognizes the effect of sediment gradation on the stream's transport capacity. It accounts for the effect of particle exchange between sediment load and bed layer and simulates bed armoring, changes in bed elevation, and longitudinal sorting of eroded material. (Cassar-FRC)
W83-03833

2K. Chemical Processes

HYDROGEOCHEMICAL INVESTIGATIONS WITH REGARD TO THE ORIGIN OF HEAVY METALS IN GROUNDWATER (HYDROGEOCHEMISCHE UNTERSUCHUNGEN ZUR HERKUNFT VON SCHWERMETALLEN IM GRUNDWASSER),
Technische Univ., Munich (Germany, F.R.). Inst. fuer Wasserchemie und Chemische Balneologie.
P. Udluft, and K-E. Quentin.
Zeitschrift fuer Wasser und Abwasser Forschung, Vol 15, No 1, p 6-11, 1982. 3 Fig, 11 Tab, 10 Ref. English abstract.

Descriptors: *Heavy metals, *Weathering, *Rocks, *Precipitation, *Groundwater, Erosion, Aquifers, Lead, Copper, Zinc, Cadmium, Chromium, Cobalt, Nickel, Mercury, Alps, *Federal Republic of Germany, Chemical analysis, Geochemistry, Geohydology, Chemical composition.

The output of heavy metals from an aquifer belonging to the zone of oxidation is mainly controlled by the weathering of rocks. A simple mass balance between the amounts of precipitation and the input into the soils by weathering shows the significance of precipitation. The concentration of heavy metals in groundwater can be explained completely by transport of solutions originating in chemical weathering. Due to the very low migration factor of iron, only this element shows a dominant enrichment in the soils caused by weathering. This highest ratio between the input of precipitation and the output of groundwater is given by Pb (80:1), followed by Cu, Zn, and Cd (10:1). The other elements (Cr, Co, Ni, Hg) are placed between 5:1 and 1:1. In the Alps, however, the input of precipitation shows the range of the groundwater output of Cu, Zn, Cd, and Pb. (Author's abstract)
W83-03511

CARBONIC ACID-CALCIUM CARBONATE EQUILIBRIUM IN SURFACE GROUNDWATERS OF NORTHEASTERN BAVARIA/F. R. G. 1. SIMPLE METHODS FOR CALCULATING 'ACIDIC AGGRESSIVENESS' AND CARBONATE DISSOLUTION TENDENCY (KALK-KOHLENSAURE-GLEICGEWICHT IN OBERFLACHENNAHEN GRUNDWASSERN NORDOSTBAYERNS I. EINFACHE GLEICHGEWICHTSBERECHNUNGEN ZUR 'SAUREAGGFRESSIVITAT' UND KALKLOSUNGSTENDENZ),
Bayreuth Univ. (Germany, F.R.). Lehrsuhl fuer Hydrologie.
T. Frevert, E. Schrimpff, and I. Baumgartner.
Zeitschrift fuer Wasser und Abwasser Forschung, Vol 15, No 2, p 58-69, 1982. 1 Fig, 2 Tab, 16 Ref. English abstract.

Descriptors: *Groundwater, *Calcium carbonate, *Acidic water, *Acidity, *Mathematical studies, Chemical properties, Chemical analysis, Water analysis, Bavaria, *Federal Republic of Germany.

Some variables pertinent for carbonic acid/calcium carbonate equilibria were determined in 15 calcareous and non-calcareous surface groundwaters of northeastern Bavaria. The measured data were compared with the corresponding thermodynamic data in order to find the degrees of non-equilibrium in the groundwaters. The use of a simple pocket computer was found to be feasible for this purpose. With respect of P(CO2) (atmosphere/groundwater) and to the dissolution tendency of calcium carbonate, non-equilibria prevailed (the so-called Langelier index i has always been negative). It seemed to be useful to introduce a parameter analoguous to the Langelier index which characterizes 'acidic aggressiveness' irrespective of the presence of undissociated calcium carbonate. Only the non-calcareous or extremely non-calcareous groundwater showed a negative 'acidic aggressiveness' parameter, corresponding to the Langelier indices of less than -2. This may be due to their high virtual dissolution intensity vs. calcium carbonates. (Author's abstract)
W83-03512

CARBONIC ACID-CALCIUM CARBONATE EQUILIBRIUM IN SURFACE GROUNDWATERS OF NORTHEASTERN BAVARIA. II. SPATIAL AND TEMPORAL VARIANCES (KALK -KOHLENSAURE GLEICHGEWICHT IN OBERFLACHENNAHEN GRUNDWASSERN NORDOSTBAYERNS. II. ZUR HYDROCHEMISCHEN RAUMLICHEN UND ZEITLICHEN VARIANZ),
Bayreuth Univ. (Germany, F.R.). Lehrsuhl fuer Hydrologie.
E. Schrimpff, T. Frevert, and I. Baumgartner.
Zeitschrift fur Wasser und Abwasser Forschung, Vol 15, No 4, p 187-191, August, 1982. 1 Fig, 3 Tab, 5 Ref. English abstract.

Descriptors: *Carbonic acid, *Groundwater, Acidity, Alkalinity, Calcium carbonate, Seasonal variations, Spatial distribution, Multivariate statistical methods, Statistical methods, Mathematical studies, *Federal Republic of Germany, Bavaria.

Samples were taken of 15 northeastern Bavarian surface groundwaters and studied for conductivity, pH, chloride content, titration-alkalinity, titration-acidity, hardness and dissolved carbon dioxide. Multivariate statistical methods were used in the evaluation of the data collected. According to the results of principal component analysis only the variables of pH, specific conductivity, alkalinity and hardness were closely correlated. All the other variables showed poorer interrelationships. Spatial clustering of the mean values of 7 non-weighted and independent variables led to 6 groups of 2 groundwaters, 1 group of 3 groundwaters and 2 single groundwaters. However, clustering all data revealed the predominance of time vs spatial variance by groups of winter-spring or spring-summer data. Combining the hydrochemical and statistical results the following conditions were characteristic for all wells: in winter - 'acidic aggressiveness' - low water yield and low buffering intensity; in spring - 'acidic non-aggressiveness' - high water yield and high buffering intensity. (Baker-FRC)
W83-03514

ACID RAIN: SOURCES AND EFFECTS IN CONNECTICUT REPORT OF THE ACID RAIN TASK FORCE,

Connecticut Agricultural Experiment Station, New Haven.
T. Bertinuson, and C. A. Frink.
Bulletin 809, January 1983. 14 p, 4 Fig, 3 Tab, 39 Ref, 2 Append.

Descriptors: *Acid rain, *Air-water interfaces, *Water-air interfaces, *Acidic water, *Rainfall, *Chemical properties, Acidity, Air pollution effects, Air pollution, Human diseases, Air-earth interfaces, Earth-air interfaces, *Connecticut.

The Acid Rain Task Force examined the nature and sources of acid rain and its effects on soil and water, fish, vegetation, structures, and human health. The study concluded that the sources of acid rain and other air pollutants in Connecticut are not readily quantified, due in part to the varied components of acid rain. Rain in Connecticut has an average pH of about 4.3 to 4.4, which is highly acidic compared to unpolluted rain which has a pH of 5.6. The more distant the source, the more difficult it becomes to specify that source. However, it is clear that regions and perhaps even states can be identified as source areas. The effects of acid rain on the environment of Connecticut are seen as subtle. The soils are generally well-buffered and show no evidence of acidification by acid rain. Measurements of the alkalinity of 35 lakes show little or no change since measurements taken in 1937-1939, but there are 1000 lakes in the state large enough to have names, and some changes may have gone undetected. There is no evidence that fish in the lakes have been affected by acid rain, nor is there evidence of damage to agricultural crops or forests. However, current levels of air pollution may cause genetic, biological and/or ecosystem changes that have yet to be identified. Structures are affected by acid rain as can be seen in the weathering of some statues and building stone. There is little evidence of any direct effect of acid rain on human health, although there is no question that some forms of air pollution are hazardous to health, such as fine particulate aerosols. (Garrison-Omniplan)
W83-03561

TEACHER'S RESOURCE GUIDE ON ACIDIC PRECIPITATION WITH LABORATORY ACTIVITIES,
Maine Univ. at Orono. Coll. of Education.
L. H. Barrow.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-227405, Price codes: A02 in paper copy, A01 in microfiche. Land and Water Resources Center Completion Report, Univ. of Maine, Orono, June 1983. 19 p. OWRT A-057-ME(3), 14-34-0001-2121.

Descriptors: *Acid Rain, Air pollution, Coal, *Education, Fallout, Oxides, Rainfall, Pollutant identification.

The purpose of this teacher's resource guide is to help science teachers incorporate the topic of acidic precipitation into their curricula. A survey of recent junior high school science textbooks found a maximum of one paragraph devoted to the subject; none of these textbooks had any related laboratory activities. It was on the basis of this near void that this manual was developed. The guide includes introductory material designed to give an overview of causes and effects of acidic precipitation, its relation to energy production, and some possible ways of reducing or eliminating it. In addition, six laboratory activities (independent of one another) are included. These investigations are appropriate for students utilizing concrete operational thought patterns. Some are modifications of activities published by the Acid Precipitation Awareness Project. The guide also refereces several additional resources for teachers and students who wish to pursue the topic futher.
W83-03565

STABLE ISOTOPIC INVESTIGATION OF THE GROUND WATER QUALITY AND TRANSPORT SYSTEMS IN THE SAFFORD VALLEY, ARIZONA,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
A. Long.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-243139, Price codes: A05 in paper copy, A01 in microfiche. Water Resources Research Center Completion Report, July 1983. 75 p, 21 Fig, 2 Tab, 31 Ref. OWRT A-107-ARIZ(1), 14-34-0001-1103.

Descriptors: Groundwater quality, Groundwater movement, Stable isotopes, Safford Valley, *Arizona, *Isotope studies, Geochemistry, Thermal water, Ion chemistry, Water-mineral equilibria.

Integration of geologic, hydrologic, major-ion chemical, stable-isotope and radioisotope data from Safford indicates that the Safford thermal waters are produced by deep circulation into the basin, which has relatively normal thermal characteristics. These waters are forced to the surface by pressure derived from the high-standing mountain ranges at the basin margins. The absence of shifts in isotopic composition off the meteoric line idicates that the temperatures in the reservoirs are too low to permitboiling (shift to the left) or water-mineral isotope-exchange reactions (shifts to the right of the meteoric line). In the absence of shifts, the isotopic compositions of the thermal waters indicate the isotopic compositions in their source area(s) and imply that the surrounding mountain ranges were the source area. The water-mineral equilibria relationships of waters sampled along hypothesized flow paths also indicate a mountain source for thermal waters and define the flow paths of waters recharged at the mountain fronts to deep aquifers in the basin sediments. Similar studies can be applied to geothermal systems throughout the Basin and Range, providing that variations in the stable-isotope and major-ion chemistry of waters are discernable in the basin of interest.
W83-03674

SOLUBILIZATION RATE OF ATMOSPHERIC PARTICULATE MATTER AND IMPACT ON WATER QUALITY,
Clemson Univ., SC. Dept. of Environmental Systems Engineering.
For primary bibliographic entry see Field 5B.
W83-03677

EFFECTS OF ACID DEPOSITION (RAIN) ON A PIEDMONT AQUATIC ECOSYSTEM: ACID INPUTS, NEUTRALIZATION, AND PH CHANGES,
Clemson Univ., SC. Dept. of Environmental Systems Engineering.
For primary bibliographic entry see Field 5C.
W83-03700

CHEMISTRY OF THE SPRINGS OF THE OZARK MOUNTAINS, NORTHWESTERN ARKANSAS,
Arkansas Univ., Fayetteville. Dept. of Geology.
K. F. Steele.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-246561, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Research Center Publication No 98, Univ. of Arkansas, Fayetteville, May 1983. 50 p, 3 Fig, 13 Tab, 26 Ref. OWRT A-055-ARK(1), 14-34-0001-1104.

Descriptors: *Chemical analysis, *Heavy metals, Groundwater, *Springs, *Arkansas, *Mineralization, Lead, *Zinc, Geochemistry.

Three lead-zinc mineralized areas of northern Arkansas were selected to study the effect of mineralization on ground water chemistry. The Ponca area has the largest amount of lead sulfide mineralization, the Zinc area has a significant amount of zinc silicate and zinc sulfide; whereas, the Rush area has zinc carbonate and zinc sulfide. A total of 143 samples were collected from these areas and analyzed for general water chemistry parameters including heavy metals. The water quality of the area is generally good, however, a few springs exceed the drinking water standards for ammonia, nitrate, iron, manganese and lead. The surface temperatures and subsurface temperatures (determined from silica geothermometry) do not indicate any significant geothermal heating of these spring waters. Geochemical exploration using ground water chemistry, especially lead, appears to be very useful in outlining these lead-zinc mineralized areas; however, location of individual deposits using ground water chemistry does not appear to be promising.
W83-03707

CHEMICAL COMPOSITION OF RAIN WATER OVER LUCKNOW IN 1980,
Central Groundwater Board, Lucknow (India).
B. K. Handa, A. Kumar, and D. K. Goel.
Mausam, Vol 33, No 4, p 485-488, 1982. 4 Tab, 3 Ref.

Descriptors: *Chemical composition, *Rain, *Trace elements, Lucknow, *India, Water analysis, Precipitation, Fate of pollutants, Metals, Acidity, *Pollutant identification.

Rainwater collected over Lucknow, India, from June to December 1980 was analyzed. This area, several hundred km from the sea, is affected by industrial and domestic air pollution, gases from anaerobic decomposition in agricultural lands and swampy areas, emanations from surface water bodies, and other airborne pollutants from adjacent areas. There was no evidence of acid rain; pH values found ranged from 6.55 to 8.15. Chemical compositicn of the rain varied with each shower, but it was predominantly of the bicarbonate type. Mean values for constituents were: electrical conductivity, 24.9 miscrosiemen per cm; bicarbonates.83 mg per liter; chlorides, 1.14 mg per liter; nitrates, 2.12 mg per liter; Ca, 1.70 mg per liter; Mg, 0.43 mg per liter; Na, 0.59 mg per liter; K, 0.32 mg per liter; and silica, 0.24 mg per liter. Mean trace element levels (micrograms per liter) were: Fe, 26.5; Zn, 9.74; Sr, 3.63; Cu, 3.08; Mn, 2.45; Mo, 1/10; and Ag, Co, Cd, Cs, Li, and Rb, all <1.0. The highest Cd value in a sample was 2.5 micrograms per liter. (Cassar-FRC)
W83-03809

2L. Estuaries

BIOGEOCHEMISTRY OF THE SEDIMENTS OF THE PAMLICO AND NEUSE RIVER ESTUARIES, NORTH CAROLINA,
East Carolina Univ., Greenville, NC. Dept. of Biology.
E. A. Matson, M. M. Brinson, D. D. Cahoon, and G. J. Davis.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-236133, Price codes: A06 in paper copy, A01 in microfiche. Water Resources Research Institute Report No 191, North Carolina State Univ., Raleigh, May 1983. 115 p, 26 Fig, 23 Tab, 150 Ref. OWRT B-143-NC(1), 14-34-0001-1256.

Descriptors: *Estuaries, *Geochemistry, *Sediments, *Nutrients, Rivers mud, Sand, Sediment-water interfaces, Interstitial water, Cycling nutrients, Carbon, Nitrogen, Phosphorus, Phytoplankton, Bacteria, *North Carolina, Neuse River, Pamlico River.

This is a survey of the composition, distribution, and sources of surface sediments in the Pamlico and Neuse River Estuaries. The interstitial(pore) waters of the sediments were also studied to estimate the decomposition stoichiometry of organic matter and the diffusive flux of NH, FRP(filterable reactive phosphorus), SO, Si, DIC(dissolved inorganic carbon), and Cl. The sediments of the two estuaries were quite similar. Mud deposits (>90% silt + clay) covered 90% of the area of both, and the remainder was sandy sediments near shore or upriver of the transition zone. There was a progressive decrease in total organic carbon(TOC) and total phosphorus(TP) concentrations downriver, but the total Kjeldahl nitrogen(TKN) did not change. Data indicate that deposition of estuarine phytoplankton carbon governs the organic chemistry of the top meter of sediments in the lower two thirds of the estuaries, while in lower-salinity upriver areas, freshwater carbon is evident. Total annual diffusional flux of NH and FRP from the sediments represents 7.7 and 5.4% of average

annual phytoplankton N and P uptake in surface waters. Bioturbation and advection of pore waters, as well as large pulsed nutrient fluxes from anoxic bottom waters, could increase these estimates almost 5 fold. Only about half of the calculated N and P of phytoplankton sedimentation is returned to the water column, thus storage and recycling of nutrients within the sediments is occurring.
W83-03620

TROPHIC ENERGETICS IN ARCTIC FRESHWATER ECOSYSTEMS,
Alaska Univ., Fairbanks. Inst. of Water Resources.
D. M. Schell, and P. Ziemann.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-236141, Price codes: A02 in paper copy, A01 in microfiche. Completion Report 80-11, October 1981. 17 p, 5 Fig, 12 Ref. OWRT A-069-ALAS(1), 14-34-0001-1102.

Descriptors: *Aquatic productivity, *Primary productivity, Food chain, Food pyramids, *Food webs, Limnology, Ecology, Fishes, Rivers, Ecology, *Detritus, Aquatic life, *Alaska, Colville River, *Organic carbon, Harrison Bay.

The inputs of organic carbon from the Colville River and from shoreline erosion to Harrison Bay dominate the energy input to this system. This large input of allochthonous carbon is utilized by microorganisms and the secondary production is transferred up the food web to comprise a large fraction of the carbon in amphipods sampled from Harrison Bay during November, based on the carbon-14 content of the amphipods. The anadromous fishes entering marine waters attain an isotopic composition typical of marine fishes by late summer. Upon entering the freshwater system, however, the food web dependencies shift drastically and by spring, the anadromous fishes sampled (least cisco, broad whitefish) were almost completely derived from peat as indicated by a large depression in C-14 content. These data indicate two critical facts regarding anadromous fish populations: 1. Overwintering anadromous fishes in the Colville River feed actively and turn over their entire body carbon. They do not overwinter on fat reserves acquired during summer marine feeding. 2. Overwintering fishes are heavily dependent upon peat as an energy source, probably via insect larvae as principal consumers. By June, least cisco and broad whitefish are 69-65% peat carbon.
W83-03621

DEVELOPMENT OF REGIONAL WETLAND RESTORATION GOALS: COASTAL WETLANDS,
California Coastal Commission, San Francisco.
For primary bibliographic entry see Field 6G.
W83-03691

ENGINEERING WETLANDS: CIRCULATION, SEDIMENTATION, AND WATER QUALITY,
California Univ., Davis. Dept. of Civil Engineering.
R. B. Krone.
In: Wetland Restoration and Enhancement in California, M. Josselyn, ed. California Sea Grant College Program Report No T-CSGCP-007, Tiburon Center for Environmental Studies, San Francisco State Univ., December 1982. p 53-61, 4 Fig.

Descriptors: *Wetlands, *Dikes, *Marshes, *Sedimentation, *Water quality, *Soil engineering, Estuaries, Hydraulic design, Tidal flats, Tides, Soil stability, Suspended solids, Sedimentation rates, Flood control storage, Algal control, Catchment areas.

Marshes result from the combined effects of tides, rising sea level, sediment transport, and marsh plants. Restoring diked lands to viable marshes includes restoration of flooding and draining regimens by gravity flows, and importation of fresh sediments that provide conditions for growth of desired plant species. Marsh plants promote deposition of sediment among themselves by facilitating aggregation of suspended particles and by protecting deposited material from wave action. Hydraulic design consists of application of unsteady flow computations to the peculiar conditions of marshlands, with tides, friction, and conveyance dimensions, either specified or adjustable. One-dimensional hydraulic representations are suitable; two-dimensional models are too detailed. Methods for constructing dikes and channels on marshlands is difficult because excavating equipment gets mired in the saturated soil. Data on suspended sediment concentrations, needed to compute sedimentation rates, are rarely available so they must be estimated using rates from other sites. However, rates of sedimentation in shallow ponds typically slow as the water gets shallower. Water quality in restored marshes requires minimizing conditions favorable for mosquito larvae, such as by providing drainage for depressions in the marsh surface, and preventing the development of algae scum by providing short retention time in ponds and channel ends that do not drain completely. Lands to be restored to marsh might have other uses, such as recreation, education and/or flood water storage. These factors must be considered in designing the physical facilities. (Atkins-Omniplan)
W83-03693

RESTORATION TECHNIQUES, RESEARCH, AND MONITORING: VEGETATION,
San Diego State Univ., CA.
J. Zedler, M. Josselyn, and C. Onuf.
In: Wetlands Restoration and Enhancement in California, M. Josselyn, ed. California Sea Grant College Program Report No T-CSGCP-007, Tiburon Center for Environmental Studies, San Francisco State Univ., December 1982. p 63-74, 9 Tab.

Descriptors: *Wetlands, *Marshes, *Coastal waters, *Regional development, *Vegetation, Ecosystems, Wildlife habitats, Submerged plants, Algal control, Grasses, Saline soils, Salt marshes.

Marsh vegetation provides a transition from aquatic to terrestrial habitats. This paper summarizes the ecological features of wetland vegetation, reviews data on California's wetland vegetation, outlines ecological factors in planning marsh establishment, and suggests research programs to improve restoration efforts. The emphasis is on emergent and submerged vegetation, particularly salt marshes. California's wetlands have extremely variable hydrologic regimes, some stressful and some beneficial to plant productivity. Soil salinity is also a major factor in marsh composition and productivity. The three main restoration goals--restoring what has been degraded, turning dredge spoil deposits into wildlife habitat, and treating sewage effluent--require appropriate communities. The techniques used to do that include modifying water circulation, establishing new substrate elevations, and planting. Some values that argue for incorporating eelgrass beds in coastal wetland restoration are that primary production is very high, it may filter sewage, coastal stabilization could occur, the density and biomass of animals is much higher, and the environment enhances fish production. Restoration techniques are still experimental; therefore, once the restoration goals and site conditions, including elevations and soil characteristics, have been established, specific implementation plans can begin. The site should be monitored before and after implementation. These efforts must be sufficient to determine what caused a success or failure and the results should be made readily available to be useful to future projects. (Atkins-Omniplan)
W83-03694

ANALYSIS OF COASTAL MARSH ECOSYSTEMS: EFFECTS OF TIDES ON VEGETATIONAL CHANGE,
Connecticut Univ., Storrs. Inst. of Water Resources.
W. C. Kennard, M. W. Lefor, and D. L. Civco.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-246926, Price codes: A08 in paper copy, A01 in microfiche. Completion Report, June 1983. 151 p, 30 Tab, 47 Fig, 25 Ref, 3 Append. OWRT B-014-CONN(1), 14-34-0001-0212.

Descriptors: *Aerial photography. *Coastal marshes, *Computer applications, *On-site data collection, *Plant populations, *Remote sensing, *Satellite technology, *Spartina, Spatial distribution, *Tidal marshes, *Tide effects, Temporal distribution, Vertical distribution, Aquatic ecosystems, Ecology, Elevation, Species density, Species diversity, Topographic mapping, *Connecticut.

Three study sites along the Connecticut coast were used for detailed analysis of tidal regime, salt marsh vegetation distribution, and microelevation. Surveyed belt transects extending from water's edge to upland transition, measuring 10 x 70 m, and onsite tide gauges were established and data gathered over three seasons. Elevation and plant species distribution data were subjected to discriminant analysis. It was determined that the landward extent of Spartina alterniflora Loisel. (tall form) indicates the line of mean high water on a salt marsh. Photointerpretation, mapping, and cover analysis of successive imagery from five overflights from 1934 to 1981 showed a net increase in coverage by S. alterniflora, perhaps indicating a response to an increase in sea level, among other factors. Digitized vegetation maps were used to detect changes in plant species distribution. An image processing system, PICPAC, was developed for thematic mapping of coastal ecosystems cover types from digital satellite imagery. The report contains extensive narrative enhanced by 30 tables and 47 figures, including 18 manually-prepared and nine computer-generated cover classification maps.
W83-03708

MINERALOGY OF SEDIMENTS IN THREE ESTUARIES ON OAHU, HAWAII,
Hawaii Univ. at Manoa, Honolulu. Water Resources Research Center.
P. C. Ekern, and P-F. Fan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-248310, Price codes: A03 in paper copy, A01 in microfiche. Technical Memorandum Report No 68, June 1983. 33 p, 7 Fig, 8 Tab, 34 Ref. OWRT A-043-HI(6), 14-31-0001-4011, -5011, 14-34-0001-7025, -7026.

Descriptors: *Mineralogy, *Sediments, *Estuaries, Alluvial deposits, Geomorphology, X-ray diffraction, Watersheds, *Oxisol, *Mollisol, *Inceptisol, Vertisol, Kaneohe Bay, Maunalua Bay, Pearl Harbor, *Hawaii.

Semiquantitative X-ray diffraction was used to determine the relative abundance of minerals in sediments from three estuaries on Oahu, Hawaii. The watersheds of the three sites represent diverse environments: Kaneohe Bay, a windward northeast facing lagoon-bay complex; Maunalua Bay, a leeward south facing, heavily urbanized area; Pearl Harbor, a blend of urban-agricultural estuarine complex on the leeward central portion of Oahu. Five suites of mineralogic assemblages were found: basaltic, secondary clay, hydrothermal-aeolian, marine carbonate, and authigenic. Carbonates prevailed in the sediments in Kaneohe Bay except near stream mouths. Primary minerals of the basaltic suite dominated the terriginous sediments from the streams, buy iron-rich secondary minerals were common and quartz and mica of aeolian origin and some hydrothermal christobalite were present. Secondary clay minerals and hematite were the main constituents of the suspended sediments carried to Maunalua Bay. In Pearl Harbor the basaltic suite was dominant near the stream mouths. Secondary clays and aeolian quartz and illite were found where salinity and currents allowed deposition. Authigenic pyrite was formed where anaerobic conditions developed in organic depositions. Montmorillonitic minerals correpond to the source soils derived from tuff. Heavy metals in Kaneohe Bay resembled the soil and rock levels but considerably higher levels were found accumulated in the fine sediments in Pearl Harbor.
W83-03728

METAL SURVEYS IN SOUTH AFRICAN ESTUARIES V. KROMME AND GAMTOOS RIVER (ST. FRANCIS BAY),
Port Elizabeth Univ. (South Africa). Dept. of Zoology.

For primary bibliographic entry see Field 5B.
W83-03738

METAL SURVEYS IN SOUTH AFRICAN ESTUARIES VI. SUNDAYS RIVER,
Port Elizabeth Univ. (South Africa).
For primary bibliographic entry see Field 5B.
W83-03739

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

RO VS. MSF FOR HIGH-CAPACITY SEAWATER DESALINATION PLANTS,
Du Pont de Nemours (E.I.) and Co., Wilmington, DE.
C. T. Sackinger.
Power Engineering, Vol 86, No 8, p 56-58, August, 1982. 3 Fig, 2 Tab, 7 Ref.

Descriptors: *Reverse osmosis, *Desalination, *Multistage flash distillation, Distillation, Seawater, Membrane processes, Flash distillation, Costs, Capital costs, Energy.

Reverse osmosis offers several advantages over multistage flash (MSF) distillation for seawater desalination. Energy costs for reverse osmosis are significantly less than for thermal processes. For a 5.56 mgd dual-purpose reverse osmosis plant producing 71.4 MW of electric power, energy requirements are 6.61 kWh per cu m of water produced. Fuel consumption is 19.38 tons per hour for reverse osmosis and 21.5 tons per hour for MSF. Annual fuel savings are 18,536 tons or $3.7 million cost savings at a price of $30.60 per barrel. Capital costs for a Key West, Florida, 3 mgd reverse osmosis plant put on line in December 1980 were $3 per gallon processed per day. (Cassar-FRC)
W83-03622

NOVEL COMPOSITE MEMBRANES,
Bend Research, Inc., OR.
E. K. L. Lee, H. K. Lonsdale, W. C. Babcock, R. P. Barss, and M. E. Tuttle.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-243170, Price codes: A04 in paper copy, A01 in microfiche. Completion Report, April 1983. 40 p, 20 Fig, 8 Tab, 16 Ref. OWRT C-10004-S(No 1449)(1).

Descriptors: *Membranes, *Desalination, *Reverse osmosis, *Chlorine, Saline water, Seawater, Brackish water, *Composite membranes, Chlorine resistance, Mechanisms of chlorine attack, Membrane processes.

A serious limitation of most high-performance composite reverse-osmosis (RO) membranes is their sensitivity to chlorine attack. The objective of this program was to develop membranes with good desalination performance and improved chlorine resistance. A composite polyamide membrane designated 3N8(OL) was developed which exhibited no significant degradation with over 50 days of cumulative exposure to 0.5 ppm chlorine (as NaOCl) at pH 6.5. This degree of chlorine resistance was comparable to that of the best commercial membrane (FT-30 produced by FilmTec Corporation). The best 3N8(OL) membranes exhibited an NaCl rejection of 99.32% and a water flux of 34 gal/ft super 2-day (gfd) under the test conditions of 800 psi and 1-wt% NaCl feed; with a 3.5-wt% NaCl feed the rejection obtained was 97.9% at a water flux of 12 gfd. Thus, this membrane is suited for brackish-water treatment but not for single-pass seawater desalting. Even better chlorine resistance was exhibited by a second membrane, designated 2N31. At the end of a 500-hour accelerated chlorine-resistance test at 10 ppm NaOCl and pH 6.5, no salt rejection decrease was detectable. At 800 psi and with a 1-wt% NaCl feed, the average salt rejection observed was 97.7% and the water flux was 7.4 gfd. Thus, this membrane is superior in chlorine resistance to 3N8(OL) or FT-30 but has only modest RO performance. The probable mechanisms of chlorine attack in polyamide membranes and the likely identity of the reacting species have been summarized.
W83-03678

3B. Water Yield Improvement

GEOPHYSICAL MAPPING TECHNIQUES FOR GROUNDWATER AVAILABILITY, CENTRAL PIEDMONT PROVINCE, NORTH CAROLINA,
Guilford Coll., Greensboro, NC. Dept. of Geology and Earth Sciences.
C. C. Almy, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-235770, Price codes: A02 in paper copy, A01 in microfiche. Water Resources Research Institute, Completion Report, North Carolina State Univ. at Raleigh, May 1983. 20 p, 56 Ref. OWRT A-118-NC(1), 14-34-0001-1135.

Descriptors: Geophysics, *Groundwater availability, Gravity studies, Magnetic studies, Seismology, *Water supply development, Groundwater mining, *Groundwater potential, Bedrock, Alluvium, Geologic fractures, *North Carolina, *Mapping.

Limited surface water supplies in populous Guilford County, North Carolina, necessitate wise use and management of groundwater resources. In the search for suitable groundwater supplies, this study explores the usefulness of gravimetric, magnetic, and refraction seismic techniques in differentiating among types of bedrock, soil/saprolite, and floodplain alluvium as well as the detection and delineation of hydrologically important fracture zones. Gravity and magnetic surveys have proved useful in delineating major bedrock units. Seismic refraction work indicates alluvial fill over the bedrock directly or over saprolitic material in the valley. Preliminary studies of fracture patterns and the development of predictable fracture occurences aid in groundwater recovery. The ability to map the unconsolidated cover, as well as the underlying bedrock, permits closer control on groundwater migration and occurences and provides the possibility of using the regolith as a primary water source, as well as the fractured bedrock, the traditional source of groundwater in this area. The successful applications of these geophysical techniques can reduce the risk and cost of locating high-yield wells.
W83-03612

SOME CURRENT PROBLEMS IN INVESTIGATIONS OF THE INTERACTION OF SUBSURFACE AND SURFACE WATERS OF THE USSR,
Vsesoyuznyi Nauchno-Issledovatel'skii Inst. Gidrogeologii i Inzhenerdoi Geologii, Moscow (USSR).
For primary bibliographic entry see Field 6D.
W83-03734

WATER HARVESTING FOR AFFORESTATION: III. DEPENDENCE OF TREE GROWTH ON AMOUNT AND DISTRIBUTION OF PRECIPITATION,
Research Inst. of Forests and Rangelands, Tehran (Iran).
A. Kowsar.
Soil Science Society of America Journal, Vol 46, No 4, p 802-807, July-August, 1982. 1 Fig, 2 Tab, 17 Ref.

Descriptors: *Water harvesting, *Water supply development, *Surface runoff, Asphalt, Paving, Water resources development, *Iran, Irrigation practices, Trees, Vegetation establishment, *Tree growth, Precipitation.

Information was sought concerning the continued survival and growth rate of the rain-fed, nonirrigated trees in the afforestation projects in Iran. Verification was also sought of the runoff efficiency predictive equation is presented in earlier studies, and predictive equations were developed which could be used in planning aforestation projects with and without employing procedures for water harvesting. In order to harvest the needed water for sustaining tree growth, asphalt was sprayed onto the sloping soil surface, and runoff from the sealed area was conserved in soil of level basins constructed below them. Drought-enduring, cold-resistant trees were planted in these basins. The complete deterioration of the asphalt membrane 5 years after installation along with growth of vegetation on these treated and untreated control plots has reduced efficiency of both to almost nil. Survival of the tree species 9 years after planting on asphalt-treated and control plots was not significantly different statistically. Although the runoff contribution of the asphalt-sprayed microwatersheds was negligible during the 1975-78 period, the additional water received by the treated trees in previous years resulted in extra growth of height, crown area, and stem cross section. The tree species varied considerably in response to the additional water, apparently due to the differences in the phenology and physiology of a leguminous tree, a nonleguminous tree and a coniferous tree. Trees on asphalt-plots generally grew taller than controls. It was concluded that water harvesting by soil surface application of asphalt is a low cost substitute for the wasteful irrigation practices presently used for establishing greenbelts in Iran. (Baker-FRC)
W83-03752

STREAM-WATER STORAGE IN THE OCEAN USING AN IMPERMEABLE MEMBRANE,
Hawaii Univ. at Manoa, Honolulu. Water Resources Research Center.
E. T. Murabyashi, M. Asuka, R. Yamada, Y. S. Fok, and H. K. Gee.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-248369, Price codes: A04 in paper copy, A01 in microfiche. Technical Report No 152, May 1983. 67 p, 15 Fig, 2 Tab, 30 Ref. 4 Append. OWRT B-065-HI(1), 14-34-0001-9262, 2113.

Descriptors: *Water storage, Moveable dams, *Reservoir linings, *Reservoir storage, *Membranes, Hydraulic, models, Irrigation water, *Stream-water storage, West Loch, Pearl Harbor, Oahu, *Hawaii.

The conceptual feasibility of storing fresh water in the ocean was investigated using a plastic membrane as the reservoir liner. In the initial phase, two physical hydraulic models were constructed to test the concept. The first was a water-filled, glass-sided box to observe the movement and reaction of the membrane to various simulated effects of currents, waves, and sediment deposition. The second was a 1:400-scale model (6.7 x 6.1 m) of West Loch, Pearl Harbor (a potential field application site), with 1:24 vertical exaggeration for similitude. The curtain method was used because it can enclose a large water body. The effect of wind, waves, tides, and currents on the curtain were simulated and the reactions observed. Although modeling is a useful tool for investigating initial concepts, its direct field application is limited because of scaling. Actual field testing on an initial pilot-stage basis constituted the second phase. Curtains, floating reservoirs, and bags were constructed of polyethylene sheets and deployed. All worked well after modifications were made following initial testing. The bag is the easiest to deploy because it is prefabricated and ready for use. No field attachment of floats and anchors is necessary as for curtains or floating reservoirs; however, the latter two have certain characteristic advantages which may override this difficulty. Based on this experimental experience, the concept of membrane water-shortage appears feasible and further development work leading to operational equipment seems justified. Selection of suitable membrane material is one of the key factors to be explored, along with effects of weathering and biota. Quiescent waters are essential to the success of this concept.
W83-03772

DEEP WELLS DON'T RUN DRY,
J. Gordon.

New Zealand Jornal of Agriculture, Vol 145, No 6, p 8-9, December, 1982.

Descriptors: *Wells, *Aquifers, *Irrigation water, Canterbury, *New Zealand, Groundwater irrigation.

Irrigation wells sunk within the past 5 years near Canterbury, New Zealand, began to run dry during the drought of last summer and autumn because they had been drilled too shallow during a period of high water table. The North Canterbury Catchment Board is involved in groundwater use and planning to help farmers sinking new wells to choose a proper location and depth for reliable water supplies. Some older wells in the region, believed to be going dry, upon investigation were found to be clogged by failure of screening systems and corrosion. For this area groundwater irrigation is most sensible. Supplies are nearly inexhaustible because several large gravel bed aquifers, remnants of ancient rivers, run through the area. (Cassar-FRC)
W83-03810

3C. Use Of Water Of Impaired Quality

INNOVATIVE TECHNOLOGY RECYCLES WASTE.
Hirsch and Co., San Diego, CA.
For primary bibliographic entry see Field 5D.
W83-03545

A SURVEY OF SOILS IRRIGATED WITH ARKANSAS RIVER WATER,
Arkansas Univ., Fayetteville. Dept. of Agronomy.
J. T. Gilmour, H. D. Scott, and R. E. Baser.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-235234, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Center Publication No 96, Univ. of Arkansas, Fayetteville, March 1983. 46 p, 4 Tab, 19 Ref, 1 Append. OWRT A-062-ARK(1), 14-34-0001-2104.

Descriptors: Irrigation, Conductivity, Hydrogen ion concentration, Saline water, *Saline soils, Salinity, *Soil physical properties, Sodium, *Sodium chloride, Water quality, *Arkansas River, Arkansas, *Irrigated soils.

Interest in the use of Arkansas River water for irrigation has increased recently as land adjacent to the river is converted to crop production and river water is considered as an alternative to depleted underground supplies. Since the Arkansas River can contain elevated concentrations of sodium chloride, this study was designed to determine if soil conditions adverse to crop growth were developing where river water has been used. The impact of river water on sites where river water was used as either the sole source for up to three years or a supplement to another surface source for up to twenty years was evaluated. The mean surface and profile ESPs were both 3.7%, while parallel ECs for a 1:2 soil:water extract were 183 and 163 umhos/cm, respectively. Mean surface and profile chloride concentrations were 32 and 50 ug/g, respectively. Mean saturated hydraulic conductivities were 0.0115 cm/hr for the surface soil. No data were obtained which suggested that the use of the Arkansas River under the conditions described above was detrimental to soil physical or chemical properties. Periodic re-evaluation of this conclusion is suggested at site where direct use of Arkansas River water continues for an extended period of time.
W83-03589

GROWTH, DEVELOPMENT, AND ROOT QUALITY OF SWEET POTATO AS INFLUENCED BY SOIL WARMING,
North Carolina State Univ. at Raleigh. Dept. of Horticultural Science.
D. C. Sanders, W. C. Porter, R. W. Skaggs, and D. M. Scheirer.
HortScience, Vol 16, No 4, Aug 1981. p 537-539, 1 Fig, 3 Tab, 6 Ref. OWRT A-060-NC(6), 14-31-0001-4033.

Descriptors. *Thermal water, *Heated water, *Plant growth, *Soil temperature, Subsurface irrigation, Sweet potatoes, Waste heat, Sprinkler irrigation, Crop production.

Power plants are a major source of waste heated water which because of the known effects of thermal pollution cannot be returned as is to native water resources. Previous studies have indicated a beneficial use of heated water; namely soil warming, which enhances growth of various plants. In the present work fresh and dry weights of the above ground plant of 'Copper Skin Jewel' and 'Jewel' sweet potatoes (Ipomoea batatas (L) Lam.) increased with soil warming but total yield of roots was unaffected. Soil warming increased root size, root epidemal color intensity, and improved internal color but decreased percent dry weight, and root pH. Evaporative cooling reduced the foliage weight, storage root fresh weight and total weight of 'Jewel' but not of 'Copper Skin Jewel.' Subirrigation did not influence any of the parameters mentioned above.
W83-03615

AN EVALUATION OF SEASHORE MALLOW, KOSTELETZKYA VIRGINICA (L.) PRESL., AS A POTENTIAL NEW CROP WHICH CAN BE GROWN IN BRACKISH WATER,
Delaware Univ., Newark. School of Life and Health Sciences.
F. G. Somers, and D. M. Grant.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-236109, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Center Completion Report, Univ. of Delaware, Newark, June 1983. 32 p, 20 Tab. OWRT A-048-DEL(2).

Descriptors: *Brackish water, *Seashore mallow, Irrigation water, *Marsh plants, Agriculture, Crop production, Alternative water use, Nutrients, Salt water use, *Salt tolerant plants, Saline water.

Seashore mallow, Kosteletzkya virginica (L.) Presl., a plant native to brackish areas of coastal marshes of southeastern United States, was grown in field plots irrigated with water from a tidal stream and in the laboratory in a nutrient solution (Hoagland's) salinized with sea salts. In the field the seed yield did not respond to application of N-P-K fertilizer, in contrast to previous observations. The plants grew well when irrigated 0, 3, or 5 times weekly with tidal-stream water. The highest yields were with 0 and 5X and with a 22.5 cm spacing between plants. In growth-chamber experiments, growth was reduced by salinity, particularly 10 o/oo. Markedly greater growth was obtained when the nutrient solution was changed weekly and the nutrient solution was aerated, but in the presence of an excess of a slow-release fertilizer aeration resulted in reduced growth and lowered the pH. Salinization of the nutrient solution increased diffusive resistance, decreased the water lost by transpiration, and reduced the chlorophyll content of the leaves. The amount of water lost per gram increase in dry matter was decreased by salinization. Despite a very substantial transpirational water loss, most of the Na super + remained in the nutrient solution at the end of the experiments.
W83-03618

THE NITROGEN BALANCE OF VEGETABLE CROPS IRRIGATED WITH UNTREATED EFFLUENT,
Chile Univ., Santiago. Dept. of Inorganic and Analytical Chemistry.
For primary bibliographic entry see Field 5B.
W83-03745

3D. Conservation In Domestic and Municipal Use

DISCUSSION: RESIDENTIAL WATER CONSERVATION,
Blatchley Associates, Inc., Denver, CO.
R. K. Blatchley.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 108, No WR2, p 240-242, June, 1982. 2 Ref.

Descriptors: *Water conservation, *Peak demand, *Domestic water, Municipal water, Water use, Pricing, Water demand, Irrigation, Lawns.

The paper, 'Residential Water Conservation' by J. E. Flack, published in the Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers in March, 1981, is described in this discussion as academic and idealistic. Estimates, not hard data, were used. The paper failed to mention that reducing peak flow demands may require significant capital costs. Recycling treated wastewater for public use, as suggested, is not allowed by law in some states. The critic felt that some of the figures on lawn size and daily household demand were exaggerated. A 100% irrigation efficiency in lawn watering is not attainable. Water use restrictions by scheduling reduce peak demand but may not reduce overall consumption. (Cassar-FRC)
W83-03658

WATER CONSERVATION IN RESIDENTIAL DEVELOPMENT: LAND-USE TECHNIQUES,
American Planning Association, Chicago, IL.
W. Sanders, and C. Thurow.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-249573, Price codes: A03 in paper copy, A01 in microfiche. Planning Advisory Service Report No 373. American Planning Association, Chicago, December 1982. 34 p, 26 Fig, 1 Tab, 46 Ref, 3 Append. OWRT C-00018-T (No 0425)(1).

Descriptors: *Water conservation, *Urban planning, *Zoning, *Land use, *Local governments, Conservation, Legal aspects, Governments, Urbanization, Landscaping.

This report, written for land-use planners in local government, describes how local governments around the country are reducing residential water demands. In particular, it examines water conservation provisions in comprehensive city plans on zoning and subdivision regulations designed to conserve water. It discusses how such land development considerations as housing types, lot layout, landscaping requirements, and density provisions can be used to reduce water consumption in new residential development. The report also provides an overview of the more general and more widely used techniques for residential water conservation: economic incentives, building code provisions, and public education programs.
W83-03716

3E. Conservation In Industry

ECONOMICAL WATER USE AND RECOVERY OF VALUABLE MATERIALS BY MEANS OF ION EXCHANGERS IN THE SURFACE FINISHING INDUSTRY (WIRTSCHAFTLICHE WASSERVERWENDUNG UND WERTSTOFFRUCKGEWINNUNG DURCH IONENAUSTAUSCHER IN DER OBERFLACHENVEREDELNDEN INDUSTRIE),
K. Fischwasser.
Wasserwirtschaft-Wassertechnik, Vol 32, No 8, p 260-263, August, 1982. 8 Fig, 3 Tab.

Descriptors: *Water use efficiency, *Water conservation, *Metal-finishing wastes, *Ion exchange, *Waste recovery, Water treatment facilities, Drinking water, *German Democratic Republic, Metal-finishing industry, Cation exchange, Anion exchange, Wash water, Nickel, Economic aspects, Costs, Recycling, Wastewater renovation, Wastewater treatment, Desalination, Industrial water.

The economical use of water is important in the chemical and electrochemical metal surface-finishing industries, both to minimize the consumption of drinking water for industrial purposes and to recover constituents of wastewater for conservation and environmental reasons. In the German Democratic Republic (GDR), ion exchange has been

used for this purpose. The purpose has been used successfully since 1968 for wash water desalination and wash water circulation management. For salt concentrations of 1-3 mmol/1 and two-level load, water savings of about 3.5 million cu m/yr for approximately 50 ion exchange facilities are realized (a saving of 95% of circulating water volume). The capacity of individual plants lies between 3 and 225 cu m/hr; the plant with the highest capacity is the Halle drinking water treatment facility, which exports water to the USSR. The disadvantage of ion exchange is that it requires regenerating chemicals, which can in themselves cause pollution; methods of reducing their use include reduction of wash water salt content, counterflow ion exchange with a cation exchanger, and compound regeneration between strong and weak basic anion exchangers. Two ion exchangers for nickel recovery have been operational since 1981 in Dresden. These plants could also be used to recycle other metals, such as copper and zinc with acid electrolytes. Ion exchange without recycling electrolysis is presently being instituted in the GDR. In the GDR, there are 20 facilities for phosphoric acid regeneration (iron removal) using acid cation exchange resins. Ion exchange, together with other procedures, is being tested for use in chromic acid recycling. (Gish-FRC)
W83-03521

INDUSTRIAL WATER REUSE WITH COUPLED-TRANSPORT MEMBRANES,
Bend Research, Inc., OR.
For primary bibliographic entry see Field 5D.
W83-03604

3F. Conservation In Agriculture

DREDGED SEDIMENT FOR AGRICULTURE: LAKE PARADISE, MATTOON, ILLINOIS,
Illinois Univ. at Urbana-Champaign. Dept. of Agricultural Engineering.
W. D. Lembke, J. K. Mitchell, J. B. Fehrenbacher, and M. J. Barcelona.
Illinois Water Resources Center Research Report No 175, January 1983. 42 p, 13 Fig, 11 Tab, 21 Ref, 3 Append.

Descriptors: *Lake sediments, *Soil-water-plant relationships, *Dredging, *Agriculture, *Crop production, Economic yield, Corn, Water quantity, Water supply, Sediments, Nutrients, Potential water supply, Farming, Dewatering, *Illinois.

Sediment was hauled from Lake Paradise, a water supply lake for Mattoon, Illinois, applied to a demonstration site of farmland on the lake watershed. The sediments in the upper portions of the lake contained levels of trace metals which were very near the north hemispheric average for soils. The sediments were also balanced in nutrients and lower in total metal levels than some commercial soil amendments, resulting in a composition most closely comparable to the soil and cow manure. Results of the application showed a significant yield increase of corn on the hauled sediment plots compared to the original farmland. About a $100 per acre net increase resulted, which would help defray some costs of lake reclamation. It was found that the costs of lake reclamation by applying dredged sediment to farmland using terraces is directly related to the steepness of the land slope. Spray irrigating sediment was found to be comparable in cost to storing behind terraces, with the disadvantage that spray irrigation is limited to soils or special soil management practices where erosion can be controlled. A study of the water chemistry of Lake Paradise during the dredging operation indicated that the project had a minimal effect on lake water quality. Frequently, the limiting process in dredging operations is the rate of dewatering of the dredged materials. If certain admixtures of soil amendments can be used to improve dewatering properties, then using dredged material to reclaim agricultural soils can be optimized. (Garrison-Omniplan)
W83-03558

OPTIMUM WATER USE IN FRUIT CROP PRODUCTION,
Southwest Missouri State Univ., Springfield. Dept. of Agriculture.
B. D. Fuqua.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-243089, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Center Completion Report, Univ. of Missouri, Columbia, November 1982. 32 p, 4 Fig, 6 Tab, 16 Ref, 3 Append. B-130-MO(1), 14-34-0001-9080.

Descriptors: Irrigation, *Irrigation requirements, *Irrigation efficiency, *Drip irrigation, Soil water, *Water stress, Leaf-water potential, Soil-water potential, Saturated soil, Tensiometer, Fruit crops, Water use efficiency, Strawberries, Blueberries, Fragipan soils, Newtonia soil, Viration soil, *Soil water tensions, *Missouri, Springfield.

The effect of varying soil water tensions of the growth of strawberry (Fragaria annanassa) and highbush blueberry (Vaccinium corymbosum, V. australe) plants were studied in growth chamber and field experiments. Plants, grown in porous media in growth chambers, were more vigorous, had larger leaf areas, and higher xylem potentials when the media was maintained at high moisture contents. Visual symptoms of plant stress were evident in plants grown at soil water tensions above 0.80 bar. In the field studies, highbush blueberry plants made maximum growth in well drained, well aerated , moist soil conditions. Vegetative growth during the first two years of plant establishment was not significantly different as long as soil water tensions remained less than 0.65 bar. Blueberry plants grown in soils that remained wet for extended period of time made very little or no growth. The use of sawdust and/or wood shavings as surface mulches were beneficial in maintaining soil water tensions of less than 1 bar throughout the growing season. A drip irrigation system was effective in maintaining a soil water tension of 0.30 to 0.65 bar, a range that appears to be optimum for strawberry and blueberry plants. Sporadic rainfall and vast differences in drainage of soils make it difficult to define an irrigation schedule to encompass all soil conditions encountered in production of small fruit crops. Monitoring soil water tensions by use of tensio-meters was an effective method of checking water content in the moisture range needed for growth of strawberry and blueberry plants. Utilization of instruments to monitor soil moisture should result in conservation of energy, water, and labor required in growing small fruit crops.
W83-03669

EVAPORATIVE COOLING BY MIST AND SPRINKLE IRRIGATION AND CONSERVING WATER IN VEGETABLE IRRIGATION IN ARIZONA,
Arizona Water Resources Research Center, Tucson.
A. J. Pratt, and F. C. Harper.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-248328, Price codes: A02 in paper copy, A01 in microfiche. Completion Report, January 1983. 20 p, 7 Fig, 6 Tab, 14 Ref. OWRT A-101-ARIZ(2), 14-34-0001-1103.

Descriptors: Vegetables, *Evaporative cooling, *Water conservation, Irrigation systems, *Sprinkle irrigation, *Mist irrigation, *Arizona, Water use efficiency, *Crop response, Crop yield, Peppers, Tomatoes, Potatoes.

Temperature, yield response and water-use efficiency are given for eight cultivars of peppers, two of tomatoes and one of potatoes irrigated by deadlevel furrow, regular and intermittent rotating sprinkling and micromist with bare soil, with black plastic mulch alone, and with clear plastic tunnels plus black mulch for the first three weeks after setting the plants. Peppers responded very well to both the black plastic mulch and the clear plastic tunnels plus the mulch, with significant total yield increases and water-use efficiency increases. Tomatoes gave both yield and water-use efficiency increases for the plastic mulch but not the tunnels. Potatoes also responded well for the black plastic mulch. Micromist resulted in the highest water-use efficiency (yield/cm of water applied). Graphs show the cooling effect of intermittent sprinkling on pepper fruits, potato foliage and soil 10- and 15-cm deep under pepper and potato plants.
W83-03729

STATISTICAL ANALYSIS OF CROP YIELD CONTROLLED LINE-SOURCE IRRIGATION,
Agricultural Research Organization, Bet-Dagan (Israel). Volcani Center.
E. Bresler, G. Dagan, and R. J. Hanks.
Soil Science Society of America Journal, Vol 46, No 4, p 841-847, July/August, 1982. 4 Fig, 3 Tab, 9 Ref.

Descriptors: *Irrigation practices, *Crop yield, *Statistical analysis, Mathematical studies, *Line-source irrigation, Spatial variability, *Variagram, Corn, Wheat.

Analysis was made of the statistical spatial structure of the crop yield of an agricultural field due to variability of various factors influencing it. It is demonstrated that by operating with the scaled variable one can filter out the trend imposed by the variable water application volume and therefore reveal the influence of other factors such as soil properties and genetic and experimental errors. The major conclusions were, first, that a stationary, well-behaved varigram achieved for the yield is scaled with respect to its average at a given irrigation level. The average depends strongly on the irrigation level. Second, the variability of yield related to factors other than soil properties is small. Third, soil variability may have a much larger effect upon yield. Fourth, the latter has a spatial structure which has to be inferred in order to carry out statistical analysis of the field. The average and variance depend in this case on the size of the field. (Baker-FRC)
W83-03753

HEAVY WATER TRACING OF SOIL-WATER TRANSFERS UNDER IRRIGATION,
CEA Centre d'Etudes Nucleaires de Cadarache, Saint-Paul-les-Durance (France). Service de Radio-Agronomie.
For primary bibliographic entry see Field 2G.
W83-03755

A MODIFIED LINE SOURCE SPRINKLER TECHNIQUE FOR CONTINUOUS-VARIABLE LEACHING STUDIES,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
J. C. Stark, W. M. Jarrell, and J. Letey.
Soil Science Society of America Journal, Vol 46, No 2, p 441-443, March/April, 1982. 2 Fig, 1 Tab, 5 Ref.

Descriptors: *Sprinkler irrigation, *Leaching, Infiltration, Permeability, Soil water, Water supply, Fertilizers, Pesticides, Irrigation programs, Irrigation.

An irrigation system was designed which can produce a continuous range of leaching fractions. The leaching variable is produced by supplementing standard sprinkler irrigation with line source irrigation. The advantages of this modified line source technique include the capability of applying a continuous leaching variable to plots receiving uniform applications of sprinkler applied fertilizers or pesticides, the ability to adjust the slope of the water application gradient to produce the desired range of leaching fractions, and the option of a backup irrigation system when wind speed is too great for line source irrigation. By applying a chemical injector at the head of the main line, this system can also be used to apply uniform amounts of sprinkler applied fertilizers, herbicides, or insecticides to plots which receive line source irrigation. This technique could thus be used in studies designed to compare the effectiveness of surface applied and injected chemical sources at different levels of leaching. (Baker-FRC)
W83-03767

WATER AND ENERGY CONSERVATION IN IRRIGATED AGRICULTURE: AN ARID AREA TECHNOLOGICAL AND ECONOMIC CASE STUDY,
Arizona Univ., Tucson.
J. C. Wade.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-248377, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Research Center Completion Report, Tucson, Ariz., July 1983. 43 p, 13 Tab, 26 Ref. OWRT B-094-ARIZ(3), 14-34-0001-1202.

Descriptors: *Irrigation efficiency, *Economic efficiency, Cost-benefit analysis, Groundwater, Energy, Linear programming, *Arizona, Water conservation, Energy conservation, Prices, Water policy.

Conservation, efficiency and optimization go hand in hand in irrigated agriculture. Water and energy in Arizona agriculture is utilized in relationship to the efficiency of existing technology or technology that can be utilized by investing additional capital. Programs, policies and prices are the major factors influencing the use of water and energy. In Southern and Central Arizona substantial incentives exist from all three to encourage wiser and more efficient utilization of irrigation resources. Four case studies and an initial conceptualization summarize the potential short and long term effects on Arizona's irrigated agriculture. The increasing cost of irrigation water pumped in Arizona and the policies enacted by the State have created a new environment in which water can not be treated as a free good. Investment in laser leveling of fields and large scale linear move sprinkling irrigation systems seem to offer the best alternatives to keep irrigation cost in line with long term profitability. At any rate it can be expected that irrigated acreage in most areas of the state will decrease as will the net returns from irrigated farming. The changes will be uneven as areas of larger pump lifts and shorter growing seasons adapt differently. The basic resource endowment of soil, climate, and groundwater are fundamental in assessing the impacts of change. But equally important is human resourcefulness and captial expenditure. Conservation as a response to economic incentives prove to be as important as the policies enacted by the State. Work will continue based on the data collected and models designed from this research. This data will be organized and systematic analysis of policies and programs affecting irrigated agriculture will continue.
W83-03773

CONSTANT-FLUX INFILTRATION FROM A HEMISPHERICAL CAVITY,
Massey Univ., Palmerston North (New Zealand). Dept. of Soil Science.
For primary bibliographic entry see Field 2G.
W83-03782

SELECT HARDY PASTURE FOR DROUGHT SURIVAL.
New Zealand Journal of Agriculture, Vol 145, No 6, p 12-13, December, 1982.

Descriptors: *Pastures, *Drought resistance, Grasses, Legumes, Clover, Grazing, *New Zealand.

Pasture species suitable for use in drought conditions in New Zealand are identified. The ryegrass cultivars, Nui and Ellet, show the least drop in production and best persistence in stressful summer conditions. The properties and conditions for growth of other grasses and clovers are discribed. (Cassar-FRC)
W83-03789

IRRIGATION FUNDING NOW MORE RATIONAL,
For primary bibliographic entry see Field 6F.
W83-03811

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

RIVER MANAGEMENT RESEARCH NEEDS,
Connecticut Univ., Storrs. Inst. of Water Resources.
For primary bibliographic entry see Field 6B.
W83-03601

HYDRILLA MANAGEMENT IN NORTH CAROLINA.
In: Proceedings, Workshop May 4, 1982, Raleigh, NC. Water Resources Research Institute, North Carolina State Univ., Raleigh, July 1983. 43 p, Witzig, A., Heimerman, J., and Partington, B., ed.

Descriptors: *Aquatic weeds, *Aquatic weed control, *Management, Planning, Lakes, Rivers, Ponds, *Herbicides, Physical control, Mechanical control, Fish, Proceedings, *North Carolina, Biocontrol.

This publication is a compilation of papers presented by hydrilla experts from around the Southeast during a workshop held on May 4, 1982. Hydrilla is a fast-growing aquatic weed that develops dense mats of vegetation which can choke irrigation systems and restrict boating, fishing, and swimming. The workshop was held to obtain a better understanding of hydrilla and the potential problem it poses to surface waters in North Carolina; to review the management efforts of other states and agencies; to evaluate approaches needed to develop a hydrilla management program for this state; and to determine additional research and educational needs. To those ends, papers were presented on such topics as the biology of hydrilla, the status of this plant in North Carolina, and alternatives for control. These topics and others are covered in this publication. Papers are included on chemical, physical, mechanical, and biological control. Also provided is information on the hydrilla management programs of Florida and South Carolina, and the hydrilla contingency plan for the Tennessee Valley Authority watershed. The research program and activities of the U.S. Army Corps of Engineers are also presented. Finally, there is a summary of the research and control needs for North Carolina.
W83-03616

CONSERVATION ASPECTS OF TWO RIVER IMPROVEMENT SCHEMES IN THE RIVER THAMES CATCHMENT,
K. G. Weeks.
Journal of the Institution of Water Engineers and Scientists, Vol 36, No 6, p 447-458, December, 1982. 5 Fig, 5 Tab, 2 Ref.

Descriptors: *Environmental effects, *Aquatic habitats, *Channel improvement, Fish, Conservation, Habitats, Dredging, Roding River, Stort River, Flood control, Aquatic plants, Vegetation, Revegetation, Banks, Stream banks, Grasses, Wildlife.

This paper reviews the conservation projects carried out on the rivers Stort and Roding, Lea Division, Thames Water Authority, during 1978-81. A flood alleviation scheme was built on the Stort to protect Bishop's Stortford from damages of a 70-year flood. The dredging and widening of the river was done from the water to minimize damage to trees and bank plants and animals. Tip sites were planted with 1/3 standard trees and 2/3 whips, doubling the number of trees at no extra cost. Selected areas were not reseeded to permit indigenous plant species to revegetate the sites. Natural wetlands were protected from damage. The Abridge flood alleviation scheme on the river Roding involved remodeling of an old brick and arch bridge and river works. The original river bed was preserved wherever possible. When extreme meanders had to be eliminated, new artificial cavities were constructed to provide fish cover. Within 2 years the bank plants and animals had recolonized. However, kingfisher and sand martin nesting sites had been lost. A survey of fish populations before and after river works showed an overall increase. (Cassar-FRC)
W83-03646

INTEGRATION OF MANAGEMENT METHODS WITH THE LIFE CYCLE AND ECOLOGY OF THE FILAMENTOUS ALGA, PITHOPHORA,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
S. W. O'Neal, D. F. Spencer, and C. A. Lembi.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-243196, Price codes: A04 in paper copy, A01 in microfiche. Technical Report No 154, April 1983. 62 p, 22 Fig, 34 Ref. OWRT B-119-IND(1).

Descriptors: Algae, *Nuisance algae, *Algal control, Algal growth, Algicides, Germination, Aquatic productivity, Copper sulfate, *Chlorophyta, *Pithophora, *Indiana, Water pollution control.

Pithophora oedogonia is a green filamentous alga. It is a free floating organism forming thick, heavy mats of vegetation that can fill in small impondments. It is generally a serious management problem because of its apparent resistance to standard algicides. In Indiana the alga overwinters as vegetative filaments and akinetes (nonsexual, thick-walled spores). Akinetes comprise approximately 21% of the overwintering free-floating biomass. Akinetes and overwintering filaments germinate to produce new vegetative filaments in the spring in response to an increase in water temperatures and a replenishment of nutrients. Net photosynthesis increases from a low in midwinter to a high in mid June and July. Biomass accumulation peaks in late September - early October. Akinetes are also present on the bottom sediments. Their germination occurs approximately a month after germination of akinetes in free-floating mats. The spring akinete germination period is critical because this is the time when most algicide treatments are made. This study shows that germination and initial germ tube elongation are dependent on the respiration of internal stored materials and are simazine-insensitive. Germinating akinetes are also relatively insensitive to copper sulfate. The inherent tolerence of germinating akinetes to simazine and copper sulfate plus the extended germination period due to sediment akinete germination may be a major reason the ineffectiveness of spring algicide treatments. Other alternatives such as copper treatments in late winter prior to akinete germination are being explored.
W83-03680

ENGINEERING WETLANDS: CIRCULATION, SEDIMENTATION, AND WATER QUALITY,
California Univ., Davis. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2L.
W83-03693

TECHNOLOGY TRANSFER PROGRAM: URBAN STORMWATER MANAGEMENT IMPLEMENTATION IN IOWA,
Iowa State Univ., Ames. Dept. of Civil Engineering.
R. L. Rossmiller.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-246454, Price codes: A05 in paper copy, A01 in microfiche. Iowa State Water Resources Research Institute Completion Report No 132, March 1983. 100 p, 7 Fig, 2 Tab, 9 Ref. OWRT A-082-IA(1), 14-34-0001-2117.

Descriptors: *Detention reservoirs, *Hydraulic design, *Hydrographs, *Land use, *Planning, *Urban hydrology, Culverts, Design floods, Legal aspects, Model studies, Multipurpose reservoirs, Storm sewers, *Storm water, Watersheds, *Iowa, Outlet structures, Watershed planning.

The objective of the recently completed Iowa Urban Stormwater Management Program was to make stormwater management an integral part of the activities of planners, engineers and politicians in existing urban areas and in new developments around metropolitan areas. Included in this overall objective were the legal institutional, planning and technical aspects of stormwater management. Two concurrent studies were undertaken at the University of Iowa and at Iowa State University. The studies at the University of Iowa Law College concentrated on the legal and institutional aspects of urban stormwater management: how it is being implemented around the United States, what is possible under existing Iowa law, the development of model ordinances, and various methodologies for funding the construction and maintenance of stormwater facilities. The studies at Iowa State University concentrated on the planning and technical aspects of urban stormwater management: planning on both a watershed and an individual development basis, the use of both structural and non-structural measures, and the effectiveness of on-site and off-site engineered facilities for both the primary and major systems. Emphasis was placed on the design of storm sewer systems and on the design of stormwater detention basins: various methodologies for the development of inflow hydrographs, the physical characteristics of basins for the development of stage-volume curves, and the hydraulics of several types of outlet structures for the development of stage-outflow curves. The results of these studies are contained in a planning and design manual.
W83-03696

4B. Groundwater Management

ARTIFICIAL GROUNDWATER RECHARGE, SAN LUIS VALLEY, COLORADO,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
D. K. Sunada, J. W. Warner, and D. J. Molden.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-227371, Price codes: A07 in paper copy, A01 in microfiche. Colorado Water Resources Research Institute Completion Report No 123, Colorado State University, Fort Collins, March 1983. 140 p, 39 Fig, 8 Tab, 33 Ref, 2 Append. OWRT A-050-COLO(1), 14-34-0001-1106 & 2106.

Descriptors: *Artificial recharge, *Computer models, *Groundwater recharge, *Mathematical models, *Colorado, San Luis Valley, Groundwater depletion, Aquifers, Computer programs, Microcomputers, Graphics display.

Intense use of aquifers for irrigation waters has caused groundwater storage depletion in many areas of the arid and semi-arid west, including the San Luis Valley in south central Colorado. Artificial recharge is a means of alleviating this problem. To show the practical benefits of artificial recharge to local water users, a demonstration recharge basin was operated in the San Luis Valley. Both numerical and analytical models were calibrated to the aquifer response to suggest operational policies. Analysis of the results of the demonstration project indicate that if recharge operations are conducted during the non-irrigation season when excess water is available, significant amounts of water can be added to storage and combat groundwater depletion. One difficulty with the use of models is that the results obtained are hard to visualize by non-technical persons. Recently a wide variety of microcomputers have become available which are relatively inexpensive and have the capability of readily evaluating solutions which describe groundwater response to artificial recharge. Their portability and graphics features make them excellent demonstration tools. As part of this study, a computer program was written which uses Glover's (1960) solution for recharge from a rectangular basin to model artificial recharge. The program is totally interactive, extremely user friendly, and runs on an Apple II+ 48K microcomputer. The model describes groundwater response to artificial recharge in an infinite, homogeneous aquifer and in a stream aquifer system and can also calculate discharge into a stream. The model is designed for use by both technical and non-technical persons, and is an excellent means of transferring knowledge from groundwater hydrologists to water users. The microcomputer model developed in this study could be used in other parts of the San Luis Valley to evaluate the benefits of artificial recharge in these other areas.
W83-03562

USE OF FERRUGINOUS GROUNDWATERS TO AUGMENT STREAMFLOW,
For primary bibliographic entry see Field 5G.
W83-03577

INJECTION AND THERMAL BREAKTHROUGH IN FRACTURED GEOTHERMAL RESERVOIRS,
California Univ., Berkeley. Lawrence Berkeley Lab.
For primary bibliographic entry see Field 2F.
W83-03585

A RIVER BASIN NETWORK MODEL FOR CONJUNCTIVE USE OF SURFACE AND GROUNDWATER: PROGRAM CONSIM,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6A.
W83-03596

IMPACT OF ARTIFICIAL RECHARGE ON GROUNDWATER QUALITY OF GYPSUM AQUIFER IN HARMON COUNTY, OKLAHOMA,
Oklahoma State Univ., Stillwater. School of Civil Engineering.
For primary bibliographic entry see Field 5B.
W83-03607

ENGINEERING AND LEGAL RAMIFICATIONS OF GROUNDWATER CONTAMINATION - A CASE STUDY,
Dufresne-Henry, Inc., Concord, MA.
For primary bibliographic entry see Field 5G.
W83-03626

WATER BALANCE OF THE PEARL HARBOR-HONOLULU BASIN, HAWAII, 1946-1975,
Hawaii Univ. at Manoa, Honolulu. Water Resources Research Center.
T. W. Giambelluca.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-243121, Price codes: A08 in paper copy, A01 in microfiche. Technical Report No 151, May 1983. 149 p, 41 Fig, 65 Tab, 203 Ref, 2 Append. OWRT A-089-HI(1), 14-34-0001-1113.

Descriptors: *Water balance, *Groundwater recharge, *Precipitation, *Runoff, *Evapotranspiration, Irrigation, Pearl Harbor Basin, Honolulu Basin, Sugarcane irrigation, Lawn irrigation, Fog drip, *Hawaii.

The basal aquifer underlying the Pearl Harbor-Honolulu Basin comprises the principal source of water supply for municipal demands of greater Honolulu and the demands of irrigated agriculture. Declining freshwater head and increasing chlorinity of coastal well water have led to recent groundwater development controls in the area. Determination of the sustainable (safe) yield of the basin requires a spatially and temporally detailed estimate of the recharge. The water balance of the basin was computed for 258 discrete zones at a monthly interval over the 1946 to 1975 (360 months) period. Results of the analysis include estimates of monthly precipitation, fog drip, sugarcane irrigation, urban lawn sprinkling, runoff, evapotranspiration, and groundwater recharge for each zone. The average recharge rate of the critical Pearl Harbor region was found to be 11.74 m super 3/s (268 mgd), of which 2.98 m super 3/s (68 mgd) is derived from the return of applied irrigation water. Results indicate that the groundwater resources of the basin are sufficient to support a population increase of approximately 450,000, should sugarcane and pineapple cultivation be discontinued.
W83-03673

A COMPARATIVE EVALUATION OF GROUND-WATER MANAGEMENT TECHNIQUES,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
J. L. Emel, J. M. Dworkin, T. Maddock, III,, and M. Bradley.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-246538, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Research Center Completion Report, Tucson, Arizona, July 1983. 54 p, 2 Tab. OWRT B-081-ARIZ(1), 14-34-0001-0204.

Descriptors: *Water management, *Water law, Aquifer management, *Groundwater management, Western U.S., Water policy, Water supply.

A summary and evaluation of groundwater supply management programs inthe western United States is presented. Statutes, district manadates, and court decisions set out general objectives which are interpreted and implemented by administrative agencies. While the objectives are for the most part philosophically derived, the implementation mechanisms are the result of both philosophic interpretation and hydrologic science. As established in this research, the objectives of state and district groundwater supply policies are property rights protection and aquifer development management. The former relates to protection of access, and the latter to planned depletion or conservation goals (i.e., 'safe yield'). Various management appoaches are discussed which reflect the variety of interpretations and emphasis given these objectives by the various agencies. The differences in and impacts of groundwater management tools in western states are investigated toward understanding the tradeoffs in selection of management criteria and procedures. A hydrologic response model is used to illustrate the conclusions.
W83-03704

INSTITUTIONAL FRAMEWORK FOR CONJUNCTION USE OF SURFACE AND GROUNDWATER IN TUPELO-LEE COUNTY, MISSISSIPPI: PHASE II,
Mississippi State Univ., Mississippi State. Water Resources Research Inst.
R. E. McArthur, and D. B. Brammer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-249623, Price codes: A04 in paper copy, A01 in microfiche. Completion Report, April 1983. 52 p, 34 Ref. OWRT A-137-MS(1), 14-34-0001-2126.

Descriptors: *Management, Planning, *Institutional constraints, *Conjunctive use, Groundwater management, Water supply, Groundwater availability, Surface water availability, *Mississippi, Tupelo-Lee County.

Excessive pumping of groundwater in Lee County, Mississippi, has caused a serious lowering of the water table. An engineering study has recommended that the area take action to alleviate this situation through conjuctive use of groundwater and surface water. Experience in other areas has shown, however, that there are often institutional barriers to the intergovernmental water planning and management necessary for conjunctive use. It is feared by some observers that similar obstacles might frustrate the effective realization of the engineering recommendations. The research focused upon the modification of intergovernmental patterns to provide conjunctive use for Lee County. The research objectives were based upon the assumption that Lee County institutional arrangements must evolve if local and regional officials are to manage the emerging water problem. The research objectives were (1) to analyze current relevant institutional arrangements which affect water resources planning and management in Lee County; (2) to present a Model Institutional Framework for modifications in these existing arrangements to encourage conjunctive use: and (3)

to propose a program of action to implement the Model Institutional Framework.
W83-03721

USE OF NATURAL UNDERGROUND RESERVOIRS FOR CONTROL OF SURFACE RUNOFF,
Ukrainskii Nauchno-Issledovatel'skii Inst. Gidrotekhniki i Melioratsii, Kiev (USSR).
B. P. Karuk, and A. N. Aliferov.
Water Resources (English Translation), Vol 9, No 2, p 169-171, March-April, 1982. 4 Fig, Translated from Vodnye Resursy, No 2, p 79-82, March-April, 1982.

Descriptors: *Water supply development, *Underground storage, Water supply, *USSR, Ukraine, Water quality control, Runoff, Water storage, Artificial recharge.

Various studies have been conducted in the USSR to examine the possibility of artificial replenishment of groundwaters and creation of underground reservoirs in a number of regions in the Ukraine. The geological and hydrogeological conditions of the Crimean plains permit creating here large underground reservoirs with a total volume of about 1.5-2.0 cubic kilometers. All water surpluses of the North Crimean Canal can be fed into the underground horizons composed of porous, fractured limestones. Depending on the water quality in the source and requirements imposed by various consumers on water from underground reservoirs, two approaches to the problem of conditioning water being fed into the underground horizons are possible. First, all water purified to the required degree of quality. Secondly, water is fed directly without pretreatment or with medium treatment to remove suspended material in settling ponds or in the rock stratum. This is possible under the following conditions: the water from the underground reservoirs is used mainly for irrigation or industrial water supply; there is no threat of polluting adjacent aquifers which are the source of domestic potable water supply; and there is no threat of clogging and additional pollution of the enclosing rocks. With consideration of imminent water management problems in a number of regions of the country it is expedient to accelerate a study of the feasibility and creation of underground reservoirs. (Baker-FRC)
W83-03758

EFFECT OF MOWING HEIGHT UPON CONSUMPTIVE WATER USE, GROUNDWATER RECHARGE AND RECHARGE QUALITY FROM BERMUDAGRASS WATERED WITH SECONDARY TREATED EFFLUENT,
Arizona Univ., Tucson. Dept. of Plant Sciences.
W. R. Kneebone.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-253286, Price codes: A02 in paper copy, A01 in microfiche. Water Resources Research Center Completion Report, Tucson, Arizona, July 1983. 7 p, 2 Tab, 8 Ref. A-115-ARIZ(1), 14-34-0001.

Descriptors: *Consumptive use, Pan evaporation coefficients, Bermudagrass turf, Mowing height, Zeolite effluent, Groundwater recharge, Water quality, Sewage treatment.

Tifgreen bermudagrass was grown on three soil mixes (washed mortar sand, 95 sand - 5 zeolite, 90 sand, 10 zeolite) under three scheduled mowing heights (12.5, 25.4 and 37.5 mm) and irrigated with secondary sewage effluent at 100% Class A Pan evaporation (less rainfall) twice each week. Because of certain growth problems the height differentials were not fully established the first year, but water use was consistently less over the period June 1982 - June 1983 for the 12.5 mm height treatment than for the other two. Adding zeolite had no apparent effect on water use. Water use averaged 63% of pan over the first year of the experiment with the 12.5 mm treatment at 60 and the other two averaging 64. Leachate samples from all plots were analyzed at the end of the first bermudagrass season. They were free of nitrogen (same values as blanks). At the level of irrigation used the turf had unthrifty growth suggesting limited nutrient availability. The turf received no nutrients other than those supplied by the effluent.
W83-03816

4C. Effects On Water Of Man's Non-Water Activities

THE IMPACT OF URBANIZATION ON A FLOOD-PLAIN AQUIFER: BLOOMINGTON, INDIANA,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
For primary bibliographic entry see Field 5B.
W83-03609

PREDICTING INFILTRATION AND SURFACE RUNOFF FROM RECONSTRUCTED SPOILS AND SOILS,
Kentucky Water Resources Research Inst., Lexington.
L. G. Wells, A. D. Ward, and R. E. Phillips.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-235523, Price codes: A04 in paper copy, A01 in microfiche. Research Report No 143, July 1983. 55 p, 21 Fig, 7 Tab, 31 Ref. OWRT B-078-KY(1), 14-34-0001-1299.

Descriptors: *Infiltration, *Infiltration rate, Infiltration capacity, Runoff, *Runoff rates, Soil water, Soil water potential, *Kentucky, *Spoils, Spoil water, Spoil water potential.

A laboratory system was fabricated to measure infiltration and runoff from spoil and soil profiles constructed in rectangular bins. Construction, calibration and operation of a rainfall simulator is discussed and instrumentation used to measure transient infiltration and transmittance of water through experimental profiles is described. Spoil and soil materials from surface mines in Eastern and Western Kentucky were transported to the laboratory and used in constructing experimental profiles in rectangular bins. An extensive series of infiltration experiments were conducted utilizing a rainfall simulator and soil moistu.e monitoring instrumentation. A dual probe gamma density guage was used to measure moisture content and tensiometers were used to measure soil matric suction. Initial moisture content, bulk density and rainfall rate were varied and respective responses of infiltration characteristics determined. Extremely low infiltration rates in Western Kentucky spoil material was attributed to relatively high bulk densities and well-graded particle constituency. Conversely, extremely high infiltration rates were observed for Eastern Kentucky shale material even at very high bulk densities. The sandstone material, however, exhibited infiltration rates of the same order of magnitude as that of Western Kentucky spoil material. Soil water characteristic curves were developed using the Brooks-Corey and Gardner procedures, based upon desorption tensiometer data. Unsaturated hydraulic conductivity values were determined using the 'plane of zero flux' procedure and compared with predictions resulting from models described by Campbell, Burdine and Mualem for situations involving 'reconstructed' soil and spoil materials.
W83-03610

4D. Watershed Protection

CONSERVATION ASPECTS OF TWO RIVER IMPROVEMENT SCHEMES IN THE RIVER THAMES CATCHMENT,
For primary bibliographic entry see Field 4A.
W83-03646

THE EFFECTS OF FOREST HARVEST ON WATER QUALITY AND AQUATIC LIFE (PHASE I),
Arkansas Univ. at Monticello. Dept. of Natural Sciences.
E. J. Bacon.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-246413, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Research Center Publiction No 100, Univ. of Arkansas, Fayetteville, March 1983. 72 p, 1 Fig, 19 Tab, 1 Append. OWRT A-052-ARK(1), 14-34-0001-0104.

Descriptors: *Nitrogen, *Phosphorus, Water quality, Watershed, *Sediments, Ecosystems, *Species diversity, Management planning, *Small watersheds, Runoff, Sedimentation, Macroinvertebrates, Fish, Bioindicators, Standing crops, *Arkansas, Little Missouri River, *Clearcutting.

A long term study on the effects of clearcut forest harvest and regeneration was conducted in a representative watershed of the Ouachita National Forest. Fourteen water quality parameters were analyzed to characterize baseline water quality. Water quality was classified as excellent. A total of 350 quantitative benthic samples and 15 ultraviolet light trap samples yielded 173 species of macroinvertebrates. Mean densities of macroinvertebrates ranged from 4,800/m super 2 to 23,040/m super 2 in the upper Little Missouri River. Twenty-two quantitative collections of fishes were made at representative riffles and pools. The average biomass estimates for riffles and pools were 5.69 kg/ha and 16.66 kg/ha, respectively. The total numbers of individuals per hectare were higher in riffles than pools. Lower standing crops of fish were observed in a tributary stream to the main river. A Phase II study will evaluate and summarize the effects of clearcutting approximately 113.3 hectares of deciduous forest on water quality and aquatic life in the watershed.
W83-03686

LEGAL AND INSTITUTIONAL CONSTRAINTS AND OPPORTUNITIES IN WETLANDS ENHANCEMENT,
For primary bibliographic entry see Field 6E.
W83-03692

TOWARDS AN OVERALL STRATEGY IN DESIGNING WETLAND RESTORATIONS,
Sorensen (Jens) and Associates, San Diego, CA.
J. Sorensen.
In: Wetland Restoration and Enhancement in California, M. Josselyn, ed. California Sea Grant College Program Report No T-CSGCP-007, Tiburon Center for Environmental Studies, San Francisco State Univ., December 1982. p 85-96, 1 Fig.

Descriptors: *Wetlands, *Watershed management, *Environmental effects, *Regional development, *Resources development, Aquatic habitats, Wildlife habitats, Land use, Land tenure, Land classification, Cost-benefit analysis, Governmental interrelations.

In designing a program for restoring and enhancing wetlands in Los Angeles and Orange Counties, the author created a flow diagram which allowed for a systematic assessment of the entire restoration process. His flow diagram is for wetlands that are: 1) environmentally degraded relative to their former conditions; 2) partly or entirely in private ownership; and 3) unlikely to be restored without the infusion of private sector funds in a quid pro quo arrangement between public agencies and property owners. The majority of the approximately 110 discrete coastal wetlands in California fit these criteria. The first step in the process is to define the geographic area that will be affected by the restoration. Secondly, there should be statewide and regional analyses to identify the types and mixes of environmental factors that create optimal habitats for fish and wildlife. An impediment to the planning process is the definition of wetlands, degraded wetlands, and uplands; state, federal, and private property owners cannot agree on a definition and are in a debate over quantity versus quality of acreage. Actual ownership must also be determined. Another step is to determine the existing resource values and to establish base line data for monitoring and evaluation processes; however, this is a major problem for lack of a uniform classification system. A new

habitat and fauna classification system should be designed to indicate how they will be affected by restoration plans. A mapping system indicating type, location and density of activities and habitat would help set these regional goals. The last steps after implementation are to seek public review and comment and to evaluate the program. (Atkins-Omniplan)
W83-03695

SURFACE SOIL PHYSICAL PROPERTIES AFTER 36 YEARS OF CROPPING TO WINTER WHEAT,
Texas Agricultural Experiment Station, College Station.
For primary bibliographic entry see Field 2J.
W83-03805

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

COLIPHAGES AND COLIFORM BACTERIAIN RUNNING WATERS OF DIFFERENT QUALITY (COLIPHAGEN UND COLIFORME BAKTERIEN IN FLIESSGEWASSERN UNTERSCHIEDLICHER GUTE),
Universitaet des Saarlandes, Saarbruecken (Germany, F.R.).
U. Zaiss.
Zeitschrift fuer Wasser und Abwasser Forschung, Vol 15, No 4, p 171-177, August, 1982. 6 Fig, 2 Tab, 45 Ref. English abstract.

Descriptors: *Water quality, *Indicators, *Bacteria, Coliforms, Fate of pollutants, Coliphages, Biochemical oxygen demand, Ammonia, Phosphates, Municipal wastes.

Measurements were taken of the concentration of coliphages and coliform bacteria at 47 sampling stations of running waters in the city area and outskirts of Saarbrucken. The investigated streams were polluted to different degrees. In the water samples the numbers of coliphages and coliphages and coliform bacteria were compared with the numbers of saprophytic bacteria and levels of BOD, COD, ammonia and orthophosphate. A quality index was developed with these parameters which indicated numerically the degree of pollution. The values of all parameters increased with decreasing water quality. The concentration of coliphages correlated well with that of coliform bacteria and orthophosphate. According to these results coliphages are suitable to indicate fecal pollution. However, these measurements were made during the season of high, uniform flows; correlations might not be as good in the case of marked flow variations. Coliphage determinations are primarily suitable for rapid (5 hr) detection of viral pollution, but they should not be used as a replacement for the direct detection of Escherichia coli in drinking water, a process which requires 2-3 days. (Baker-FRC)
W83-03513

ENTEROCOCCI AND OTHER MICROBIAL INDICATORS IN MUNICIPAL WASTEWATER EFFLUENTS,
Food and Drug Administration, Davisville, RI. Shellfish Sanitation Branch.
J. J. Miescier, and V. J. Cabelli.
Journal of the Water Pollution Control Federation, Vol 54, No 12, p 1599-1606, December, 1982. 1 Fig, 8 Tab, 36 Ref.

Descriptors: *Indicators, *Bacteria, *Wastewater analysis, Pollutant identification, Monitoring, Sewage bacteria, Chlorination, *Wastewater treatment, Effluents, *Enterococci, Coliforms, Enteric bacteria, Recreation, Swimming, Viruses.

Enterococci best satisfied the requirements for a microbial indicator in wastewater effluents. Samples collected from 9 municipal wastewater treatment plants in Rhode Island after primary, secondary, tertiary treatment, and chlorination were examined for densities of enterococci, Escherichia coli, fecal coliform, total coliform, Pseudomonas aeruginosa, and Aeromonas Hydrophila. Densities of enterococci varied least from one plant to another and did not increase during primary or secondary treatment. This was not true of any other indicators tested. Mean enterococci densities (per 100 ml) were 190,000 after primary treatment; 11,000 after secondary treatment; and 1100 after tertiary treatment. Mean log 10 reductions in bacterial counts after chlorination were: fecal coliforms, 4.763; E. coli, 4.726; and enterococci, 3.573. These findings suggest that enterococci multiply little or not at all in transit to the plant and through the treatment process. They are more consistently related to the fecal wastes of the sewered population than the other organisms and may better simulate viruses with regard to chlorine sensitivity. (Cassar-FRC)
W83-03551

METHODOLOGY OF RESEARCH CONCERNING MICROPOLLUTANTS: BIOLOGICAL TESTS,
Keuringsinstituut voor Waterleidingartikelen, Rijswijk (Netherlands).
C. L. M. Poels, M. A. van der Gaag, and A. Noordsij.
Water Science and Technology, Vol 14, No 12, p 143-152, 1982. 3 Fig, 4 Tab, 8 Ref.

Descriptors: *Testing procedures, Water quality, Wastewater treatment, Fish, *Biological tests, Mutagenicity, *Pollutant identification, *Bioassay, *Toxicity, Rhine River.

In order to obtain insight into the toxicological quality of polluted waters a broad range of test methods is available. Because of the wide variability in biological effects caused by the substances present in a complex polluted water, a well considered choice of biological methods is recommended. These biological methods should be supported by, and if possible strongly integrated with, chemical analysis. For detection of harmful effects of water containing numerous pollutants in low concentrations, long term as well as embryo/larval tests with rainbow trout are applied to measure chronic toxic effects. The very important genotoxic effects, however, are missed by these tests. For this purpose Sister-Chromatid exchange tests with eastern mud minnows and Ames tests are performed. Especially the last test can be fully integrated with analytical chemical methods. Thereby it will be possible in the near future to identify the mutagenic substances and to track down their origin. The findings of these various tests indicate that the Rhine is a heavily polluted river, according to not only chemical but also biological tests. The tests mentioned can also be used to improve water quality. (Baker-FRC)
W83-03554

ALTERNATIVE METHODS OF ESTIMATING POLLUTANT LOADS IN FLOWING WATER,
Wisconsin Dept. of Natural Resources, Madison.
K. Baun.
Technical Bulletin No 133, 1982. 11 p, 2 Fig, 9 Tab, 12 Ref.

Descriptors: *Water sampling, *Pollution load, *Stream pollution, *Monitoring, *Water quality standards, Streamflow, Water quality criteria, Water quality control, Urban runoff, Statistics, Statistical analysis, Mathematical studies, Runoff.

A comparison is provided of three principal methods of estimating pollutant loads in flowing water: integration; composite; and stratified random sampling, enhanced with ratio estimation. The latter is a relatively new approach to estimating pollutant loads. It enables an estimate of confidence limits to be placed upon the loading estimates, and also enables unsampled flows to be included in the loading estimates with some knowledge of the uncertainties involved. In addition, stratified random sampling can probably give accurate loading estimates with considerably fewer samples than would normally be required with integration, and will give better estimates than other simple statistical calculations. Two disadvantages of stratified random sampling are that it becomes proportionately more expensive if the number of samples is larger than would be required for composite analyses; and larger error terms than desired can result if the appropriate number of samples is not selected. Likewise, where integration works well, it does so only because the flows are extensively sampled and, hence, is very expensive. It does not enable an error term to be placed on the loading estimates, and it has limited applicability at new stations. Composite sampling may be very accurate and inexpensive when events are well sampled. Further, it allows for excellent inter-event analysis. The major drawback is a lack of an error term. (Garrison-Omniplan)
W83-03557

DEVELOPMENT OF A CHEMICAL ANALYSIS FOR ULTRATRACE ARSENIC IN WATER,
South Carolina Univ., Columbia. Dept. of Chemistry.
S. R. Goode.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-227421, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Institute Publication No 101, Clemson Univ., S.C., May 1983. 41 p, 10 Fig, 1 Tab, 65 Ref. OWRT B-121-SC(2), 14-34-0001-9095.

Descriptors: *Arsenic, *Chemical analysis, *Drinking water, Concomitant effects, Enzymes, Fluorometry, Reaction rate determination, *Pollutant identification, Water analysis.

Arsenic is one of the most toxic elements known to man. The presence of arsenic at the 0.01 g/ml level (0.01 ppm or 10 ppb) is considered undesirable for drinking water. The water quality laboratory, however, is incapable of the detection of arsenic at these levels. Thus arsenic is seldom monitored and rarely part of a routine and comprehensive program of the measurement of water quality. A unique enzymatic method has been developed for the determination of As(V) in natural waters. The method uses arsenic to catalyze a chemical reaction which produces a fluorescent species. The method has a detection limit of 8 ng/ml. A detailed study of the mechanism and magnitude of interferences has been performed. The results indicate that only Fe super 3+ has the capability of causing erroneous results. This problem is avoided by masking with citrate.
W83-03567

NEW CORRECTION PROCEDURES FOR CHROMATE INTERFERENCE IN THE DPD METHOD FOR RESIDUAL FREE AND COMBINED CHLORINE IN WATER,
Newcastle and Gateshead Water Co., Newcastle-upon-Tyne (England).
A. T. Palin.
Journal of the Institution of Water Engineers and Scientists, Vol 36, No 5, p 351-353, September, 1982. 3 Tab, 9 Ref.

Descriptors: *Pollutant identification, *Water analysis, *Chromate, Chromium, Titrimetry, Colorimetry, Barium chloride, Thioacetamide, Water quality, *DPD method.

Water samples were prepared containing free chlorine with added amounts of chromate. Determinations on samples containing chromate were carried out after first adding 0.2 g barium chloride crystals to the 100 ml test portion. The white suspension produced did not interfere with the end point detection. Results were similarly obtained for samples containing combined chlorine from added calcium hypochlorite and ammonium sulfate. Results obtained on samples at 24C containing both chromate and residual chlorine indicated that in terms of color development after thioacetamide treatment and standing for two minutes a concentration of 5 mg/liter Cr (6+) was equivalent to 0.1 mg/liter Cl(2), a ratio which applied over the 5 to 50 mg/liter Cr (6+) range studied. In the application of the DPD method to waters containing chromate the following additional reagents are needed for

correction of any interference: barium chloride crystals in the titrimetric method and thioacetamide solution in the colorimetric method. (Baker-FRC)
W83-03579

GUIDELINES FOR SAMPLING GROUND WATER,
Texas Tech Univ., Lubbock.
G. F. Lee, and R. A. Jones.
Journal of the Water Pollution Control Federation, Vol 55, No 1, p 92-96, January, 1983. 11 Ref.

Descriptors: *Groundwater, *Sampling, *Monitoring, Planning, Acidity, Temperature, Chemical composition, Turbidity, Metals, Organic compounds, Specific conductivity, *Pollutant identification.

Guidance on how to develop suitable groundwater sampling programs by highlighting physical and chemical characteristics peculiar to groundwaters is provided, along with emphasis on reliable investigative technique. Chemical concentrations in groundwater can vary with duration of pumping and the period of time since the last pumping. Therefore, samples should be collected after a steady state condition has been reached in the sampling well. When a new well is developed for groundwater sampling purposes, it should be pumped vigorously until the water appears free of suspended solids. The well should be allowed to stand several days and then pumped again to flush it. If the water is clear, the well sampling program can begin. Groundwater monitoring wells should be positioned to monitor overall water quality characteristics of the groundwater in the region and both up and down the groundwater hydraulic gradient from suppected specific sources of contaminants such as waste disposal areas, sludge dewatering lagoons, contaminant storage areas, any sumps created to collect surface runoff, and others. Of particular concern are nearby wells used for domestic and agricultural water supply. The following parameters should be monitored: pH, temperature, specific conductance, turbidity, chloride, sodium, dissolved oxygen, calcium, magnesium, alkalinity, total organic carbon, dissolved organic carbon, soluble orthophosphate, ammonia, nitrate, arsenic, barium, beryllium, boron, cadmium, chromium, copper, fluoride, hydrogen sulfide, lead, mercury, nickel, potassium, selenium, and phenolic compounds. (Baker-FRC)
W83-03582

INVESTIGATION OF POLYCYCLIC AROMATIC HYDROCARBONS IN WATER SYSTEMS,
Connecticut Univ., Storrs. Inst. of Water Resources.
S. R. Smith, J. Tanaka, R. Collins, and J. Johnson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-235259, Price codes: A03 in paper copy, A01 in microfiche. Completion Report, March 1983. 4 p, 4 Fig, 2 Tab, 4 Ref, 1 Append. OWRT A-084-CONN(2), 14-34-0001-9007.

Descriptors: *Aromatic compounds, *Hydrocarbons, Water pollution, *Impaired water quality, Testing procedures, Hazardous materials, Water sampling, *Pollutant identification, Water analysis.

The determination of Polycyclic Aromatic Hydrocarbons (PAH) in water systems has been of great importance due to the highly carcinogenic, and in several cases, mutagenic properties of some PAH and their degradation products. An extensive literature search was carried out prior to initiation of lab work. This search indicated a need for comparing and evaluating solvent concentration techniques. Concentration of methylene chloride or ethyl ether solutions containing PAH's by nitrogen evaporation or the use of Snyder column or stainless steel gauze columns proved to be the most accurate and precise methods. Recovery of PAH's from standard solutions containing 7 PAH's yielded average recoveries between 80 and 100% + or - 10%. Preconcentration of PAH from large volumes of water using Tenax-G.C. has also been studied. Fouling of the polymer bed by iron particles or other particulate matter and a general lack of precision for the method have proven to be difficult problems to overcome. Fouling by particulate matter can be overcome by the use of prefiltering agents such as Celite-545. Improvements in precision have not yet been realized. Preconcentrations using a micro method for liquid-liquid extraction of water solutions containing PAH has been attempted. Incomplete solvent recovery has prevented reliable results. Since the adsorption onto a porous polymer resin is more convenient for field studies, large scale liquid-liquid extraction has not been pursued.
W83-03591

RIVER BASIN WATER QUALITY MONITORING NETWORK DESIGN,
Massachusetts Univ., Amherst. Dept. of Civil Engineering.
F. S. Tirsch, and J. W. Male.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-235275, Price codes: A10 in paper copy, A01 in microfiche. Water Resources Research Center Publication No 141, Massachusetts University, Amherst, March 1983. 197 p, 35 Fig, 11 Tab, 135 Ref. OWRT B-080-MASS(1), 14-34-0001-1234.

Descriptors: *Monitoring, *Stream gages, *Gaging stations, *Water pollution, *Water quality, *Water measurement, Data collections, River basins, Streamflow, Steam improvement, Waste dilution, Connecticut River, Shoshone River, Massachusetts, Wyoming.

Anyone attempting to design a surface water quality monitoring network is faced with a paradox because the statistical parameters controlling the optimality of a monitoring network are often the unknowns that the network is being designed to estimate. Resolution of the paradox is to use an iterative approach. Initial design may be arbitrary or based on experience and is refined over time in successive iterations as more information is gathered. The authors' procedure utilizes multivariate linear regression techniques and relies on the regression corrected coefficient of determination, R super -2, as measure of network reliability. Spacial design is examined given water quality data at various monitored locations. Temporal design is examined given different sampling frequencies. Spacial and temporal analyses are combined to form the space-time trade-off for the river basin. In one example for the Millers River (Massachusetts) the trade-off for monitoring mean daily streamflow is developed. In a second example for the Shoshone River (Wyoming) the trade-off for the specific conductance quality parameter is developed. Monitoring costs and monitoring benefits are discussed functions of monitoring reliability. The optimum network design occurs at that reliability for which the difference between benefits and costs is a maximum.
W83-03593

A QUESTION OF SAMPLING,
Welsh Water Authority, Powys (Wales). Directorate of Scientific Services.
For primary bibliographic entry see Field 7B.
W83-03595

THE EFFECT OF STRESS ON ORGANISMS IN THE DISTRIBUTION SYSTEM,
Delaware Univ., Newark. School of Life and Health Sciences.
D. S. Herson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-235440, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Center Completion Report, Newark, January, 1983. 46 p, 7 Fig, 3 Tab, 40 Ref. OWRT A-050-DEL(1).

Descriptors: Chlorination, *Coliforms, Enterobacter, Escherichia coli, Inhibition, Water quality, *Delaware, Wilmington.

Water microbes were subjected to stresses found in the distribution system. Recovery of the coliform (Escherichia coli) but not the non-coliform (Chromobacterium sp.) was inhibited in the presence of the other organism, a chlorine residual or temperature shift. Inhibition was more pronounced when the coliform was grown in the presence of the non-coliform and either of the other two stresses. Inhibition of coliforms was again observed when Enterobacter cloacae was mixed with large numbers of the non-coliform Moraxella sp. and millipore filtered. Scanning electron microscopy of E. coli growing in the presence of low nutrient levels or in the cold indicated that cells under these conditions had an altered morphology when compared with controls. Using concentration and enriched procedures coliforms were not isolated from Wilmington Water Department finished water. Using acridine orange staining coupled with 2-(p-iodopheny)-3-(p-nitrophenyl)-5-phenyl-tetrazolium chloride reduction (AOINT) levels of total microbes detected in water samples were orders of magnitude greater than the levels detected by the Standard Plate Count (SPC). This method, which can be used to supplement the SPC, determined metabolically active bacteria in a water sample within four hours.
W83-03602

ENUMERATION OF CHLORINE-DAMAGED FECAL COLIFORMS IN WASTEWATER EFFLUENTS,
Illinois Univ. at the Medical Center, Chicago. School of Public Health.
For primary bibliographic entry see Field 5D.
W83-03632

SEASONAL LOSSES OF N SUB 2, H SUB 2S AND CH SUB 4 FROM SEDIMENTS TO THE ATMOSPHERE FROM WETLANDS IN THE ARROWWOOD NATIONAL WILDLIFE REFUGE, NORTH DAKOTA,
North Dakota State Univ., Fargo. Dept. of Zoology.
J. J. Peterka, and R. D. Nelson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-249607, Price codes: A02 in paper copy, A01 in microfiche. North Dakota Water Resources Research Institute Completion Report, North Dakota State Univ., Fargo, June 1983. 9 p, 2 Fig, 1 Tab, 11 Ref. OWRT A-070-NDAK(1), 14-34-0001-0136.

Descriptors: *Manometers, *Methane, *Hydrogen sulfide, Gas chromatography, Sampling, Sulfur cycle, Carbon cycle, *North Dakota, *Pollutant identification, Wetlands, Arrowhead National Wildlife Refuge, *Dinitrogen, Gas sampling, Atmospheric pollution.

Methods are described for collection and analysis of dinitrogen (N sub 2), methane (CH sub 4) and hydrogen sulfide (H Sub 2S) produced in wetlands. Dinitrogen was present in all samples while methane and hydrogen sulfide were found not at all or in very small amounts. Problems with the sampling cones and collecting flasks may be responsible for the varying amounts of gases found in the samples. Correction of these problems is a primary area of concern and must be resolved before quantification can begin.
W83-03719

SAMPLING AND ANALYSIS OF INDUSTRIAL BENTHIC POLYNUCLEAR AROMATIC HYDROCARBONS IN INDUSTRIALIZED URBAN WATERSHEDS,
Alabama Univ. in Birmingham. Dept. of Chemistry.
R. L. Settine, and K. Burchfield.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-249656, Price codes: A02 in paper copy, A01 in microfiche. Water Resources Research Institute Completion Report, Auburn Univ., Ala. April 1983. 13 p, 4 Fig, 2 Tab. OWRT A-087-ALA(1), 14-34-0001-2101.

Descriptors: *Industrial wastes, *Wastewater anlysis, Industrial wastewater, Urban watersheds, Hydrocarbons, *Alabama, Opossum Creek, Gas chromatography, Mass spectrometry, *Pollutant identification.

A method is reported for the sampling and analysis that accurately describes the contour and distribution of benthic polynuclear aromatic hydrocarbons of Opossum Creek. The analytical methodology consisted of using fused silica capillary chromatography coupled with selected ion mass spectrometry to identify and quantify areas of high concentration of specific benthic compounds. It is apparent from the 'grid technique' herein reported that this model can be applied for future stream system analysis and would be an extremely reliable aid for engineering decisions with regard to cleanup.
W83-03726

REPRESENTATIVE SAMPLING LOCATION CRITERION FOR RIVERS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
T. G. Sanders.
Water SA, Vol 8, No 4, p 169-172, 1982. 3 Tab, 6 Ref.

Descriptors: *Mixing, Water quality, *Monitoring, Measuring instruments, Mathematical equations, *Sampling, Destratification, Rivers, Pollutant identification.

A quantitative criterion is presented for establishing zones of relatively complete mixing in a river. In order to effectively monitor water quality in a stream using only a single sampling point in the stream's cross section, the point being sampled should be within a zone of relatively complete mixinng. Using an analysis of variance procedure, the water quality concentration variation within a river's cross section can be analyzed to determine whether the variation is large, requiring more than one sampling point to obtain a representative sample, or small, establishing a completely mixed zone. Under most circumstances complete mixing will exist in the vertical direction prior to being completely mixed in the lateral transect, and the water quality variable concentrations will vary with time. If the variability of the concentrations in time were not taken into account in the analysis, the possibility would exist that the variability of the water quality concentrations at different locations in the lateral transect may be the result of time variability and not spatial variability. Water quality variable concentrations at just the midpoint of the river would not suffice, as the samples would not take into account the sewage effluents. Similaryly, water quality samples at either shore would not be representative, as the effluent concentrations of the sewage treatment plants would have a significant effect on the magnitude of the water quality concentrations. Therefore, it would appear that sampling at the third points of the lateral transverse would be the minimum number of sample locations to adequately define mean concentrations representative of the river's cross section at a location which is not within a zone of complete mixing. (Baker-FRC)
W83-03740

THE SUITABILITY OF M-ENDO-LES AGAR FOR TOTAL COLIFORM COUNTS BY MEMBRANE FILTRATION,
Johannesburg City Health Dept. Labs. (South Africa).
S. Lichtigfeld, and L. N. Melmed.
Water SA, Vol 8, No 4, p 173-177, 1982. 4 Tab, 14 Ref.

Descriptors: Water quality, *Pollutant identification, *Coliforms, Fecal contamination, Fate of pollutants, *Membrane filtration, Medium.

The media M-Endo-LES agar (M-LES) and M-MacConkey agar (M-Mac) were compared for carrying out coliform counts by membrane filtration on potable water samples. Notwithstanding some difficulties experienced with coliform differentiation on M-LES, it is still a more suitable medium than M-Mac and as such should replace the latter in the Standard Specification. It is evident that the dark red colonies appearing on the M-LES plates should not be ignored but should be subjected to confirmation of lactose fermentation on a medium such as M-LAC broth. Also, Aeromonas hydrophila appears as a dark red colony on M-LES, similar in appearance to the coliforms which have not developed sheen. It thus interferes with coliform identification. It is suggested that an oxidase test be carried out at the same time as the suspect colony is transferred to the lactose medium for the fermentation test to eliminate Aeromonas and other oxidase positive organisms. M-LES plates for best performance should be poured under daylight conditions and dried in an incubator at 31 degrees C. The plates should not be used immediately on preparation but between 48 hr and 5 days after pouring. The total coliform test has value as an indicator of the adequacy of water treatment processes, but the detection of E. coli 1 is the only real indication of fecal contamination. (Baker-FRC)
W83-03762

ISOLATION, IDENTIFICATION, AND DETERMINATION OF POLYCYCLIC AROMATIC HYDROCARBONS IN SEWAGE,
Akademia Medyczna, Gdansk (Poland). Dept. of Physical Chemistry.
J. Grzybowski, A. Radecki, and G. Rewkowska.
Environmental Science and Technology, Vol 17, No 1, p 44-47, January, 1983. 2 Fig, 2 Tab, 15 Ref.

Descriptors: *Wastewater analysis, *Aromatic hydrocarbons, *Organic compounds, *Pollutant identification, Polynuclear aromatic hydrocarbons, Chromatography, Liquid chromatography.

Fifteen polycyclic aromatic hydrocarbons (PAH) were simultaneously determined in sewage effluents, using high pressure liquid chromatography with ultraviolet detection at 254 nm. A standard solution of benzo(a)pyrene and benzo(b)chrysene was used as an internal standard to eliminate estimation of recovery after each run and the use of calibration curves for particular hydrocarbons. The column was packed with Zorbax ODS. The column temperature was 30C, and methanol-water (80:20) was used as the mobile phase. In the sewage effluents tested, the highest concentration of any single PAH was 14-52 ppb of benzo(j)fluoranthene. Other PAH included fluorene, phenanthrene, anthracene, fluoranthene, pyrene, chrysene, benz(a)anthracene, benzofluoranthenes, benzopyrenes, perylene, dibenzanthracenes, and benzo(ghi)perylene. PAH were detected to a lower limit of 0.1 ppb. (Cassar-FRC)
W83-03794

ENVIRONMENTAL QUALITY STANDARDS--NEW PROBLEMS FOR THE ANALYST,
G. A. Best.
Effluent and Water Treatment Journal, Vol 22, No 11, p 416-418, 420, November, 1982. 5 Tab, 6 Ref.

Descriptors: *Water quality standards, *Environmental quality, *Monitoring, Pollutant identification, Effluent standards, Standards, Fish, Toxicity, Fate of pollutants, Metals, Heavy metals, *Europe.

The EEC (European Community) has adopted the 'environmental quality objectives' (EQO) approach to emission standards in place of the previously used fixed emission standard. Although the EQO is a more realistic approach, it requires additional information such as behavior of a pollutant when it enters a river, its toxicity and interaction with other substances, and the intended use of the receiving water. Toxicity literature is far from adequate, and much data cannot be reliably extrapolated from the laboratory to natural sites. After the EQO and appropriate limits for consent conditions have been established, a monitoring program must be devised. With an EQO approach monitoring must be intensive, covering both effluent and receiving water. Analytical methods must be capable of detecting very low concentrations of pollutants, optimally 1/10 of the environmental quality standards. To minimize purchase of expensive and sensitive analytical equipment, some authorities monitor the major discharges for both pollutants and volume and calculate the concentrations of pollutants in the receiving waters from river flow data. However, there are statistical problems with this approach. (Cassar-FRC)
W83-03798

2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN IN SEDIMENT SAMPLES FROM LOVE CANAL STORM SEWERS AND CREEKS,
New York State Dept. of Health, Albany.
R. M. Smith, P. W. O'Keefe, K. M. Aldous, D. R. Hilker, and J. E. O'Brien.
Environmental Science and Technology, Vol 17, No 1, p 6-10, January, 1983. 5 Fig, 3 Tab, 18 Ref.

Descriptors: *Chemical wastes, *Organic compounds, *Landfills, Industrial wastes, Fate of pollutants, *Dioxin, Love Canal, Niagara Falls, *New York, Waste dumps, Sediments, Leachates.

Concentrations of 2,3,7,8-tetrachlorodibenzo-p-dioxin in storm sewers and creek sediments in the Love Canal section of Niagara Falls, New York, ranged from 0.9 to 312 ng per g in samples collected at six sites during 1979-80. This highly toxic, stable, water-insoluble isomer is not found in nature. Use of high performance liquid chromatography (Zorbax ODS followed by partially deactivated Zorbax Sil), capillary gas chromatography (OV-17/Poly S-179), and high resolution mass spectrometry distinguished the 2,3,7,8 isomer from the other 21 tetrachlorodibenzodioxin isomers and 75 closely related polychlorinated dibenzodioxins. The highest concentration of the dioxin isomer was found immediately adjacent to the canal at its southern end. The source of the dioxins is a heavy, chlorinated oily residue in the former chemical waste dump. (Cassar-FRC)
W83-03814

INDICES FOR WATER QUALITY ASSESSMENT IN RIVERS: A CASE STUDY OF THE LINGGI RIVER IN MALAYSIA,
Asian Inst. of Tech., Bangkok (Thailand). Div. of Environmental Engineering.
B. N. Lohani, and N. Mustapha.
Water Supply and Management, Vol 6, No 6, p 545-555, 1982. 8 Fig, 8 Tab, 3 Ref.

Descriptors: *Water quality control, *Developing countries, *Water quality indices, Rivers, Linggi river, *Malaysia, Data gathering, Multivariate factor analysis, Pollutant identification.

Opinion survey and factor analysis water quality indices (OP and FA WQI) were developed for assessing water quality in the Linggi river in Malaysia. Considering that the ratings and weightings for the OP and FA WQIs were derived by two different and exclusive ways, one by popular opinion and one purely by the use of a computer, it is interesting to note the similarity in their profiles as testified by the graphical results presented. The difference between them arises in the vastly fluctuating property of the FA index at locations of extremely good or extremely poor quality water. Thus the FA index is more sensitive. Further, it has the distinct quality of clustering important variables, thus indicating the type of pollution affecting each reach. In its similarity to the computer based FA index, the OP index may corroborate to a certain extent the somewhat underestimated capability of local water resources personnel to ascertain river water quality. In addition, continued use of the OP index may be beneficial in the long run, to assess the changes over time in human perception regarding water quality. However, it is suspected that, given the computing facilities, the FA index would be preferable for a system with a large inventory of monitoring data. (Baker-FRC)
W83-03844

5B. Sources Of Pollution

EVOLUTION OF NITRATE CONCENTRATIONS IN GROUNDWATER IN THE MIDDLE VAUD REGION (SWITZERLAND) (EVOLUTION DES CONCENTRATIONS EN NITRATES DES EAUX SOUTERRAINES DU MOYEN-PAYS VAUDOIS),
Inspectorat Cantonnal des Eaux, Lausanne (Switzerland).
E. Bosset.
Techniques et Sciences Municipales, Vol 1, p 19-28, January, 1981. 9 Fig, 24 Ref. English summary.

Descriptors: *Groundwater contamination, *Nitrates, *Switzerland, Groundwater, Drinking water sources, Orbe Valley, Venoge Valley, Molasse Plateau, Water table, Fate of pollutants, Organic compounds.

The nitrate concentration in groundwater samples of the Middle Vaud Region, and notably of the Molasse Plateau between the Lakes of Neuchatel and Morat, the Baud-Freiburg frontier, the southern border of the vast Forest of Jorat, and finally the eastern slopes of the Venoge and Orbe Valleys has gradually increased, except in the forest-clad zones protected from important foreign interferences. These data were gathered over the past 20 years. These increases are of particular interest in the Lower Broye, the part of the Plateau between the valleys of Orbe and Broye, as well as in the eastern slope of the Venoge Valley, as these zones contain high proportions of permeable soils. In several parts of the region nitrate concentrations now exceed the standard of 40 mg N03/liter prescribed by the Swiss Manual for Food Products. A precarious situation has thus been created, which requires that the applications of nitrate fertilizers on fields and meadows be drastically restricted. Control of agricultural applications is thus of chief importance. The task of the Swiss federal offices concerned is to give priority to the protection of the groundwater which is or may be use for consumption, even at the price of a decrease in agricultural output. (Baker-FRC)
W83-03508

WATER POLLUTION DUE TO INDUSTRIAL TROUT PRODUCTION IN FISH FARMS (GEWASSERBELASTUNG DURCH INDUSTRIEMASSIGE FORELLENPRODUKTION IN RINNENANLAGEN),
Wasserwirtschaftsdirektion Oder Havel, Potsdam (German D.R.).
A. Britz, and H-D. Muller.
Wasserwirtschaft-Wassertechnik, Vol 32, No 7, p 230-232, July, 1982. 7 Tab, 11 Ref. (No English Summary).

Descriptors: *Fish farms, *Trout, *Nitrogen, *Phosphorus, *Biological oxygen demand, Oxygen demand, Water quality, Water pollution, Nitrates, Nitrogen compounds, Orthophosphates, Seasonal variation, *German Democratic Republic, Population equivalents.

Water pollution studies were conducted at two East German trout farms: in May, July, and October 1975 at the Zippelsforde breeding facility (Z), where trout are fattened from about 10 g each to 40-70 g; and in June, August, and November 1976 at the Obere Plane farm (OP), where the fattened fish are brought up to their harvesting weight of about 250 g. Fish activity and food vary according to the fish's age and weight. Five-day BOD was 4,792-5,966 g/ton fish per day at Z, for an annual mean of 5,468 g/ton fish per day. The corresponding figures at OP were 3,390-4,697 and 4,047 g/ton fish per day (75 PE). At Z, nitrogen in the form of NH4-N was found at the level of 450 g/ton fish per day, with mean increases of 0.04 mg/1 on May 8-10, 0.09 mg/1 on May 17-18, and 0.21 mg/1 on October 16-17. The increases were attributed to increases and changes in food given in the course of the year and to seasonal variation in flow volume and water temperature. NO3-N annual mean concentration was 47 g/ton fish per day. Orthophosphate loads were an average of 235 and 390 g/ton fish per day at Z and OP, respectively. Corresponding figures for total phosphorus were 529 and 857 per year. The five-day BOD produced at Z correspond to that produced by 102 population equivalents (PE), that at OP to 75 PE. Corresponding values for nitrogen and phosphorus were 110 and 86 PE at Z and 109 and 140 PE at OP. (Gish-FRC)
W83-03520

BIOLOGICAL PROBLEMS IN COOLING WATER CIRCULATION (BIOLOGISCHE PROBLEME IM KUHLWASSERKREISLAUF),
Vysoka Skola Chemicko-Technologicka, Prague (Czechoslovakia). Inst. of Water Technology and Environmental Protection.
A. Sladeckova.
Wasserwirtschaft-Wassertechnik, Vol 32, No 8, p 271-273, August, 1982. 1 Fig. (No English Summary).

Descriptors: *Cooling water, *Microoganisms, *Water pollution sources, *Water pollution prevention, *Water pollution control, Cooling towers, *Czechoslovakia, Raw water, Biocides, Bacteria, Iron bacteria, Sulfur bacteria, Zoogloea, Sphaerotilus natans, Algae, Larvae, Protozoa, Environmental control, Water quality control, Aerosols, Sedimentation, Water treatment.

Undesirable micro- and macroorganisms that populate cooling facilities in Czechoslovakia are described, and methods of preventing and solving this problem are discussed. Organisms in cooling water originate in three sources: raw water obtained from treated or untreated surface water or air, and secondary multiplication of organisms from the first two sources. Colonizing organisms include Sphaerotilus natans, which is carried in with organically polluted water; sulfur bacteria, which indicate microaerobic conditions as well as the presence of sulfur (these conditions often lead to corrosion); iron bacteria, entering the system with water with an excessive divalent iron content and multiplying where corrosion exists; Zoogloea ramigera, indicating heavy organic pollution; mycophytes; algae, which occur in open facilities; protozoa and invertebrates that occur in already existing colonies; chironomid and other larvae; and the snail Physa and the mussel Dreissena, which stem from stagnant and brackish river water, respectively. All agents added to reduce corrosion and sedimentation should be tested for their biological effects. (Gish-FRC)
W83-03528

ORGANICALLY-BOUND COPPER IN LAKE AND RIVER WATERS IN JAPAN,
Environmental Pollution Research Center, Ibaraki Prefecture, Mito (Japan).
M. Negishi, and K. Matsunaga.
Water Research, Vol 17, No 1, p 91-95, January, 1983. 5 Fig, 3 Tab, 35 Ref.

Descriptors: *Copper, *Rivers, *Lakes, Heavy metals, Natural waters, Organic compounds, *Japan, Hokkaido, Fulvic acid, Humic acids.

The organically-bound copper, organic matter and the apparent molecular weight of the organic matter in lake and river waters were measured; the interaction between copper and the organic matter was also investigated at Hokkaido, Japan. The concentrations of reactive, Cu in surface water of Lake Ohnuma and the Shurunohe river ranged from 0.42 to 1.16 micrograms/liter, with an average of 0.73 micrograms/liter. The average concentration of organic copper was 0.33 micrograms/liter. Average total dissolved copper and reactive copper levels in the other lakes and rivers studied were 1.20 and 1.16 micrograms/liter, respectively. The average organic copper/total copper ration in Lake Ohnuma and the Shukunohe river was larger that those in the other lakes and river waters. The concentration of fulvic acid in all lake and river waters was 1.6 to 7.1 mg/liter, with an average of 4.1 mg/liter. The main quantity of organic matter contained in the lake water had a low molecular weight of 300-700 and was assumed to be fulvic acid originating in the river. (Baker-FRC)
W83-03536

SURVEY OF TRIHALOMETHANE LEVELS IN RHONE-ALPS WATER SUPPLIES. ESTIMATES ON THE FORMATION OF CHLOROFORM IN WASTEWATER TREATMENT PLANTS AND SWIMMING POOLS,
Institut Pasteur de Lyon (France). Lab. de Toxicologie.
P. Chambon, M. Taveau, M. Morin, R. Chambon, and J. Vial.
Water Research, Vol 17, No 1, p 65-69, January, 1983.

Descriptors: *Trihalomethanes, *Water analysis, Swimming pools, Drinking water, Surface waters, Haloforms, Organic compounds, Water pollution sources, Rhone, Alps, *France.

A survey was undertaken in the Rhone-Alps region of haloforms in various types of water samples. Drinking water samples were shown to contain very low levels of haloforms. Surface water and water at the outlet of wastewater treatment plants had significantly higher haloform levels, both around 6 times more than drinking water samples. As for swimming pools, where high levels of haloforms were found, there is a possibility that some metabolites of human origin such as citric acid and dihydroxybenzoic acid might serve as precursors. One positive argument of this theory is the fact that concentrations of haloforms found in covered swimming pools in the summer were very much higher than in winter, probably due to the large number of people bathing in the summer. (Baker-FRC)
W83-03540

OXIDATION OF FERROUS IRON BY ACIDOPHILIC IRON-OXIDIZING BACTERIA FROM A STREAM RECEIVING ACID MINE DRAINAGE,
Tohoku Univ., Sendai (Japan). Dept. of Civil Engineering.
T. Noike, K. Nakamura, and J. Matsumoto.
Water Research, Vol 17, No 1, p 21-27, January, 1983. 12 Fig, 6 Tab, 5 Ref.

Descriptors: *Iron compounds, *Bacteria, *Acid mine drainage, Fate of pollutants, Mine drainage, Aka River, *Japan, Oxidation, Iron bacteria.

The oxidation of ferrous iron by acidophilic iron-oxidizing bacteria was affected by pH, water temperature, and glucose concentration. Experiments were conducted in the field at the abandoned Matsuo sulfur and iron sulfide mine, discharging into the Aka River, Japan, and in laboratory batch and continuous experiments. Greatest activity was noted at 30 C and pH 2. The percentage oxidation of ferrous iron increased with time of river flow from the source and increased exponentially with increases in water temperature from 20 to 30 C. The iron bacteria accelerated the rate of pyrite oxidation. The number of bacteria attached to the surface of a rotating biological disk increased as the loading of ferrous iron increased from 40 to 240 g per sq m per day. (Cassar-FRC)
W83-03541

PHYSICO-CHEMICAL SPECIATION OF SELECTED METALS IN THE TREATED EFFLUENT OF A LEAD-ACID BATTERY MANUFACTURER AND IN THE RECEIVING RIVER,
D. P. H. Laxen, and R. M. Harrison.
Water Research, Vol 17, No 1, p 71-80, January 1983. 3 Fig, 10 Tab, 35 Ref.

Descriptors: *Speciation, *Industrial wastes, *Outfall, Receiving waters, Lead, Cadmium, Copper, Iron, Manganese, Heavy metals, Water pollution effects.

A scheme for the speciation of metals in freshwaters has been applied to the metals Pb, Cd, Cu, Fe, and Mn in the treated effluent of a lead-acid battery manufacturer and the receiving river upstream and downstream of the effluent outfall. The principal operations on the 15 ha site of the plant are secondary smelting of lead and fabrication of lead-acid batteries. Liquid effluent contaminated mainly with lead and sulfuric acid arise principally during lead recovery from scrap batteries, as well as during paste production and plate forming. River samples were taken within 10 min of each other during the early stages of a storm when river flow was considerably above its normal level. Comparison of samples immediately upstream and downstream of the Chloride Company outfall shows evidence of a slight dilution of some ions in the downstream sample. The increase in the total lead concentration of 10 micrograms/liter is evidence of the influx of this metal from the effluent treatment plant. Lead appears to behave differently from cadmium and copper, with the implication that if the latter are associated with humic acids then lead is probably not. The final results indicate that only in the case of lead does the effluent

discharge create a significant effect upon metal concentrations in the river. (Baker-FRC)
W83-03544

ORGANIC MICROPOLLUTANTS IN EFFLUENT RECHARGE TO GROUNDWATER,
Water Research Centre, Marlow (England).
L. Clark, and K. M. Baxter.
Water Science and Technology, Vol 14, No 12, p 15-30, 1982. 13 Fig, 5 Tab, 6 Ref.

Descriptors: *Micropollutants, *Groundwater, Water quality, Water pollution sources, *Effluent recharge, Organic compounds, Fate of pollutants, Chalk, Groundwater recharge, Infiltration, Aquifers, Water sampling, *Path of pollutants, *England, Hampshire.

Groundwater pollution by organic material derived from the recharge of raw, untreated sewage effluent has been studied at the sewage treatment works at Whitchurch in Hampshire. This organic investigation consisted of two parts; the validation of the sampling and analytical techniques and the field investigation. Sampling points for the survey included open boreholes lined with uPVC or mild steel as well as specially designed buried in situ groundwater samplers of uPVC or stainless steel construction. Laboratory leaching tests show significant pollution of sampled water by nylon and uPVC components and indicate that all plastics must be avoided in sample point construction. The in situ samplers with stainless steel bodies and PTFE sampling tubes proved satisfactory. The organic field survey showed that the organic pollution plume is conincident with the inorganic plume from the effluent recharge site. The total content of the effluent is reduced through infiltration; 85% is removed in the unsaturated zone and a further 14% during 300 m of lateral flow. The number of organic compounds at significant concentrations is also greatly reduced through infiltration. The most persistent micropollutant identified as coming solely from the sewage is dichlorobenzene, which is present at about 9 micrograms/liter below the recharge lagoons and 1 microgram/liter in the pollution plume 300 m from the site. (Baker-FRC)
W83-03553

NATURE AND ORIGIN OF MICROPOLLUTANTS,
Toronto Univ. (Ontario). Dept. of Chemical Engineering and Applied Chemistry.
D. Mackay.
Water Science and Technology, Vol 14, No 12, p 5-14, 1982. 6 Fig, 12 Ref.

Descriptors: *Water pollution sources, *Micropollutants, Water quality, Water quality control, Toxicity, Water treatment, Risk assessment, Public health, Water pollution effects.

The origins of micropollutants are discussed and classified. It is suggested that assessing the risk and ensuring an acceptably low level of adverse effects from these substances requires information on or control of three factors: exposure, toxicity and characteristics of the victim or organism, which combine to generate the toxic event. Methods of estimating exposure are discussed, especially environmental models. Ultimately, it should be possible to couple these models to toxicity data in a rational, rigorous manner to elucidate the extent of risk and control it to an acceptable level. It is futile to expect that the solution to this problem lies in any one discipline or activity such as water treatment technology, environmental exposure analysis, toxicology in the sense of biological effects of toxicants on organisms or risk assessment, and public education or indoctrination. Only by a combined balanced inter-disciplinary effort can real progress be made on all fronts to achieve an optimal reduction in real and perceived public hazard. (Baker-FRC)
W83-03555

LAND APPLICATION OF SEWAGE SLUDGE LANDFILL LEACHATE,
Rhode Island Univ., Kingston. Dept. of Plant and Soil Science.
For primary bibliographic entry see Field 5E.
W83-03563

ATMOSPHERIC RELEASE OF CHLORINATED ORGANIC COMPOUNDS FROM THE ACTIVATED SLUDGE PROCESS,
Air Force Occupational and Environmental Health Lab., Brooks AFB, TX.
For primary bibliographic entry see Field 5D.
W83-03583

A METHOD TO COMPUTE RIVER HEATING - APPLICATION TO THE MANAGEMENT OF THERMAL LOADINGS TO THE RHINE RIVER (UNE METHODE DE CALCUL DE L'ECHAUFFEMENT DES RIVIERES - APPLICATION A LA GESTION DES REJETS THEMIQUES AU RHIN),
Ecole Nationale Superieure des Mines de Paris, Fontainebleau (France). Centre d'Information Geologique.
For primary bibliographic entry see Field 5G.
W83-03584

THE FRESHWATER ASIAN CLAM (CORBICULA FLUMINEA) AS A FACTOR AFFECTING NUTRIENT CYCLING IN THE CHOWAN RIVER, N.C.,
North Carolina State Univ. at Raleigh. Dept. of Zoology.
D. D. Lauritsen, and S. C. Mozley.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-235226, Price codes: A04 in paper coopy, A01 in microfiche. Water Resources Research Institute Report No 192, North Carolina State Univ., Raleigh, May 1983. 70 p, 14 Fig, 4 Tab, 54 Ref, 3 Append. OWRT A-124-NC(1), 14-34-0001-2135.

Descriptors: *Cycling nutrients, *Orthophosphates, *Ammonia, Phosphorus compounds, Nitrogen compounds, *Clams, Benthic fauna, Excretion, Feeding rates, Algae, Cyanophyta, Anabaena, Chlorophyta, Chlorella, Scenedesmus, *Chowan River, *North Carolina.

The Asian clam (Corbicula Fluminea) has recently invaded the Chowan River and reached stable population densities(200/m2) in the northern part of the river and major tributaries. Benthic organisms such as Corbicula can affect nutrient cycling in the river by such means as burrowing, sediment reworking, and excretion. This study was conducted to evaluate the importance of the clam as a source of recycled nutrients which can contribute to the growth of nuisance blue-green algae, and to determine whether Corbicula is able to utilize blue-green algae as a food source. This work determined that, unlike many organisms, Corbicula assimilated blue-green algae(Anabaena) more efficiently than it did green algae(Chlorella and Scenedesmus). It also determined that Corbicula is able to rapidly recycle nutrients (NH4 and P04), important for algal growth. In parts of the river where the clam is abundant, excretion rates are significantly higher than sediment flux rates of the same nutrients. The clam can make a significant contribution to nutrient cycling, thus, any attempts to model nutrient cycling in the river must take Corbicula abundance into account.
W83-03588

SOURCES AND FATES OF SEDIMENTARY ORGANIC MATTER IN THE WHITE OAK AND NEUSE RIVER ESTUARIES,
North Carolina Univ. at Chapel Hill. Dept. of Geology.
L. K. Benninger, and C. S. Martens.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-235242, Price codes: A05 in paper copy, A01 in microfiche. Water Resources Research Institute Report No 194, North Carolina State Univ., Raleigh, May 1983. 72 p, 13 Fig, 3 Tab, 41 Ref. OWRT A-128-NC(1), 14-34-0001-2135.

Descriptors: *Organic matter, *Sediments, *Radioactive dating, Microbial degradation, Rivers, Estuaries, Carbon radioisotopes, Lead radioisotopes, *North Carolina, Neuse River, White Oak River.

As a substrate for microbial growth, organic matter in the sediments of rivers and estuaries represents a potential oxygen demand on, and nutrient source to, the overlying water. The actual impact of sedimentary organic matter on water quality depends upon the rate of microbial degradation, which is strongly influenced by the source(hence the composition) of the organic matter. The question of the sources and fates of organic matter in coastal sediments is addressed through the combined use of modern sediment chronology and carbon isotopic analysis (super 12C, super 13C, super 14C) of sedimentary organic matter. Sediment cores from one upriver, and one downriver location in the small, sparsely populated White Oak River estuary and the larger, more populous Neuse River estuary were studied in detail. Stable carbon isotopes in organic matter were generally heavier in downriver(relative to upriver) sediments, consistent with increased inputs of marine organic matter at downriver locations. Analysis indicated organic matter inputs include both recently produced and aged material. Because newly produced organic material is more susceptible to microbial degradation, it was expected that organic matter supplied to the river-estuary from aged reservoirs(soil, sediments, etc.) would be preferentially preserved relative to recently produced organic matter. However, the issue of preferential preservation is unresolved due to non-steady-state in super 14C concentration of organic-matter inputs.
W83-03590

THE FATE, DISTRIBUTION AND LIMNOLOGICAL EFFECTS OF VOLCANIC TEPHRA IN THE ST. JOE AND COEUR D'ALENE RIVER DELTAS OF LAKE COEUR D'ALENE, IDAHO,
Idaho Univ., Moscow. Coll. of Forestry, Wildlife and Range Sciences.
J. M. Skille, C. M. Falter, W. R. Kendra, and K. M. Schuchard.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-235309, Price codes: A08 in paper copy, A01 in microfiche. Idaho Water and Energy Resources Research Institute Completion Report, Moscow, June 1983. 156 p, 28 Fig, 28 Tab, 12 Ref. OWRT C-10103-V(No 1460)(1).

Descriptors: *Bottom sediments, *Lake sediments, *Volcanoes, *Limnology, Heavy metals, Upwelling, Biological properties, Chemical properties, Physical properties, Water chemistry, Particle size, Plankton, Benthos, *Idaho, Mt. St. Helens, Volcanic ash, Lake Coeur d'Alene, St. Joe River, Coeur d'Alene River.

The purpose of this research was to determine the effects of the tephra (volcanic ash) fallout from the May 18, 1980 eruption of Mt. St. Helens on a lake-river system 200-300 miles east of the volcano. Lake Coeur d'Alene in northern Idaho was chosen for the study as a water system which would reflect the more subtle impacts of ash fallout in contrast to the immediate and devastating impact to lakes and streams near the volcano. The specific objectives were to quantify and identify volcanic ash in the lake sediments and water columns, describe chemical conditions in the sediments and water columns, and to assess the effects of volcanic tephra on the benthic, phytoplankton, and zooplankton communities. The ash layer was relatively uniform in thickness throughout the lake and delta sediments. Sediments deposited over the initial ash layer contained only small quantities of ash. The ash layer in the lake sediments and throughout the watershed was stable and not easily resuspended or eroded. The volcanic tephra was chemically inert and had no measurable impact on water chemistry or nutrient enrichment. Benthic and planktonic communities were unchanged relative to pre-ash conditions.
W83-03597

STUDIES IN DYE-TRACING TECHNIQUES AND KARST HYDROGEOLOGY,

Kentucky Water Resources Research Inst., Lexington.
J. Thrailkill, P. E. Byrd, S. B. Sullivan, L. E. Spangler, and C. J. Taylor.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-235312, Price codes: A05 in paper copy, A01 in microfiche. Research Report No 140, July 1983. 97 p, 36 Fig, 13 Tab, 43 Ref. OWRT B-064-KY(2), 14-34-0001-9115.

Descriptors: *Dyes, *Karst hydrology, Groundwater movement, Groundwater pollution, Karst, Limestone, Aquifers, Inner Bluegrass Karst Region, *Kentucky.

Information on fluorescent dyes used for water tracing and the results of six studies are reported. Optical brightener, direct yellow, fluorscein, rhodamine (WT), and other dyes are described and the producers employed in their use in the field and in equilibration experiments are described. Three of the six studies consisted of investigations of the equilibration with passive detectors of three of the dyes. The absorption of optical brightener on fabric detectors was apparently linear with concentration and with immersion time, while detectors became rapidly saturated with direct yellow. Equilibrium of fluorescein on charcoal detectors with an elutriating solution was not achieved. Several data processing tasks were performed, including the creation of a computer file for field data and the writing of programs to sort the field data and generate plotted maps, and to display the total fluorescence of samples. A fifth study was based on a series of dye traces into Royal Spring and Russell Cave Spring in the Inner Bluegrass Karst Region. Samples were collected with an automatic water sampler and the resulting flow velocity determinations combined with discharge data provided values at a number of aquifer parameters. The most interesting results was the very small value for depth of flow. Fracture traces were identified on topographic maps and aerial photographs in the Inner Bluegrass Karst Region.
W83-03599

IMPACT OF ARTIFICIAL RECHARGE ON GROUNDWATER QUALITY OF GYPSUM AQUIFER IN HARMON COUNTY, OKLAHOMA,
Oklahoma State Univ., Stillwater. School of Civil Engineering.
A. K. Tyagi.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-235499, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Institute Completion Report, Stillwater, Okla., 40 p, 3 Fig, 3 Ref, 1 Append. OWRT A-107-OKLA(1), 14-34-0001-1138.

Descriptors: Storage coefficient, *Transmissivity, *Strongly Implicit Procedure, Method of Characteristics, *Dispersion coefficient, Groundwater pollution, Groundwater basin, Gypsum aquifer, Groundwater velocity, Water quality, *Oklahoma, *Artificial recharge, Model studies.

The strongly Implicit Procedure (SIP) is used to solve the groundwater flow equation, replacing the Alternating Direction Implicit Procedure (ADIP) in the solute transport model (1978, 1979), developed by the U.S. Geological Survey. The SIP Model was then coupled with the dispersion equation solved by the Method of Characteristics (MOC). The comparisons of the SIP-MOC Model against the ADIP-MOC Model indicate that the convergence rate in the flow portion of the problem is significantly improved, saving computer time ad the user's computer cost. The SIP Model handles problems which cannot be conveniently solved by the ADIP Model.
W83-03607

THE IMPACT OF URBANIZATION ON A FLOOD-PLAIN AQUIFER: BLOOMINGTON, INDIANA,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
M. G. Filippini, and N. C. Krothe.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-235515, Price codes: A06 in paper copy, A01 in microfiche. Technical Report No 156, March 1983. 103 p, 32 Fig, 6 Tab, 25 Ref, 5 Append. OWRT A-062-IND(1).

Descriptors: *Groundwater pollution, *Fate of pollutants, *Groundwater-surface relations, *Urban runoff, Urban watersheds, Polychlorinated biphenyls, Isotopic tracers, Bloomington, *Indiana.

The flood-plain adjacent to Clear Creek in Bloomington, Indiana was the setting for a study of the impact of urbanization on the local ground waters. Organic and inorganic water quality data were obtained from ground water below and adjacent to Clear Creek. The increased runoff and chemical pollution due to urbanization had marked effects on stream and beneath stream waters but little effect on shallow flood-plain ground waters bordering the drainage catchment. Beneath-stream groundwaters contained significantly higher concentrations of chloride, sodium and potassium than flood plain groundwaters. EPA priority pollutants were not found anywhere in the ground water system; however, PCB's were detected in the surface waters. PCB's are thus filtered out of the water by the sediment column. An oxygen isotope analysis showed that before a storm the creek is effluent with respect to flood-plain ground waters. As stage increases the steam becomes influent, returning to effluent conditions after the storm water has receded in the stream.
W83-03609

A PRELIMINARY INVESTIGATION INTO THE USE OF CRAYFISH AS A SENSITIVE SPECIES TO POLLUTANTS IN THE CLARK FORK RIVER NEAR MISSOULA, MT,
Montana Univ., Missoula. Dept. of Botany.
C. C. Gordon, and A. J. Silverman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-236117, Price codes: A03 in paper copy, A01 in microfiche. Montana Water Resources Research Report No 133, Univ. of Montana, Bozeman, June 1983. 27 p, 83 Ref. OWRT A-083-MONT(1), 14-34-0001-1128.

Descriptors: *Industrial wastes, Crayfish, Water quality, Sampling instrumentation, *Heavy metals, Sampling, Pulp waste, *Water quality, Indicators, Sensitivity, Atomic absorption, Spectra, Environmental indicators, Clark Fork River, Missoula, *Montana.

Crayfish appear to be, at least theoretically, a good indicator of water quality associated with point source pollution. An attempt to evaluate the sensitivity of crayfish to heavy metal contamination associated with the Hoerner-Waldorf (Champion International) pulp and paper mill along 30 miles of the Clark Fork and Bitterroot Rivers near Missoula, Montana, was initiated in the fall of 1977. The design for trapping and analyzing the crayfish was based upon extensive literature review and study. The analytical procedures used were standard for evaluation of heavy metals in soft tissue by atomic absorption spectra. Results of the preliminary study showed variation in concentration as a function of the animal part analyzed. Changes in concentration as a function of proximity to the pulp mill was not demonstrated; both sample number and sites were probably inadequate to show any relation to a point source, if one existed. It is concluded that crayfish chemical variation may be an important environmental indicator of pollution provided a statistically and ecologically valid sampling program were instituted to test the system.
W83-03617

MOVEMENT OF SALT AND HAZARDOUS CONTAMINANTS IN GROUNDWATER SYSTEMS,
Florida Univ., Gainesville. Dept. of Civil Engineering.
B. A. Benedict, H. Rubin, and S. A. Means.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-236125, Price codes: A07 in paper copy, A01 in microfiche. Water Resources Research Center Publication No 71, Florida Univ., Gainesville, May 1983. 126 p, 49 Fig, 4 Tab, 29 Ref, 2 Append. OWRT A-047-FLA(1), 14-34-0001-2110.

Descriptors: *Groundwater, *Water pollution sources, *Dispersion, Injection wells, Aquifers, *Path of pollutants, Model studies, *Florida, Solute transport, Stratified flow, *Saline water intrusion, Saline-freshwater interfaces.

A method has been developed to significantly reduce computer resources required to model groundwater contaminant movements. The method has been tested by applying it to the stratified flow problem of upward seepage of saltwater into freshwater aquifers overlying semiconfining formations, such as occurs in northeastern Florida. The basic equations of continuity, motion, and solute transport are solved simultaneously after being simplified by the Dupuit assumption and a boundary layer approximation. These are applied to a flow field divided into a freshwater zone, saltwater zone, and transition zone. The equations are cast in a finite difference model. Results of executing the model indicate that it is highly stable and convergent. The model is capable of describing the three-dimensional flow field and salt distribution in a transient stratified flow in an aquifer. While the specific example treated salt movement, other contaminants, including hazardous wastes could easily be modeled in the same way in a stratified flow. In addition, if the contaminant did not bring about stratified conditions or occur in a saline-stratified region, the same basic procedure can be utilized by removing contaminant influence on the flow field in the equation of motion.
W83-03619

IMPACT OF SNOWMELT-RUNOFF FROM AGRICULTURAL WATERSHEDS ON DISSOLVED OXYGEN,
Wisconsin Dept. of Natural Resources, Rhinelander.
J. F. Sullivan.
Journal of the Water Pollution Control Federation, Vol 55, No 2, p 170-177, February, 1983. 6 Fig, 2 Tab, 16 Ref.

Descriptors: *Snowmelt, *Agricultural runoff, *Nonpoint pollution sources, Fish kills, Agricultural wastes, Animal wastes, Dairy industry, *Dissolved oxygen, Upper Wisconsin River, Agricultural watersheds, Runoff, Watersheds, Water pollution sources, Fate of pollutants, *Wisconsin.

Dissolved oxygen levels dropped to as low as 2 mg per liter in some sections of the Upper Wisconsin River on March 28, 1980, shortly after the season's first major runoff event. Fish kills occurred in the Big Eau Pleine Reservoir. An investigation of water quality in tributaries and at pulp and paper plants revealed that the source of pollution was agricultural wastes such as animal and cheese wastes applied to fields. This nonpoint pollution source was not recognized previously for several reasons. An extensive automatic monitoring system has been installed. Excessive paper mill discharges, which have been reduced by pollution control, formerly masked the impact of agricultural wastes. Below normal snowfall and long periods of bare frozen soil that winter facilitated spreading of manure and cheese wastes. Nonpoint source pollution control should be implemented in problem watersheds. (Cassar-FRC)
W83-03636

A FINITE ELEMENT MODEL TO PREDICT THE FLOW OF UNDERGROUND CONTAMINANTS DUE TO LEAKAGE OF CHEMICAL AND/OR RADIOACTIVE MATERIAL FROM A BURIED CONTAINMENT,
Clemson Univ., SC. Dept. of Civil Engineering.
S. C. Anand, and A. Pandit.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-243113, Price codes: A13 in paper copy, A01 in microfiche. Water Resources Research Institute Publication No 107, Clemson Univ., S.C., June 1983. 258 p, 76

Fig, 28 Tab, 39 Ref, 13 Append. OWRT A-051-SC(1), 14-34-0001-2143, 1143.

Descriptors: *Confined aquifers, *Saturated flow, Pollutants, *Mathematical models, *Finite element method, Computer models, Numerical analysis, *Path of pollutants, Saline water intrusion, Wastewater pollution, Laminar flow, Model studies, Mass transfer, Porous media.

In this investigation, a Galerkin finite element model in two dimensions is developed to study the phenomena of mass transfer in porous media. In particular, the problems of the saltwater encroachment in coastal aquifers and the transport of hazardous wastes in groundwater environment are studied for a wide range of aquifer parameters. The coupled governing partial differential equations are nondimensionalized and solved for a two-dimensional, saturated aquifer in the vertical plane for both steady state and transient conditions using an iterative solution procedure. The flow transport is represented either in terms of the stream function or the freshwater hydraulic head. It is found that the selection of an appropriate mesh, region, and time step size is quite important to obtain correct solutions in the saltwater intrusion problem. It is shown that the saltwater intrusion is primarily a function of the ratio of the aquifer depth to the longitudinal dispersivity of the medium, and the gradient of the piezometric surface. Contaminant transport episodes are simulated for anisotropic conditions which indicate that for certain extreme values of the nondimensional parameters, nodal concentration values near the source oscillate with time. Furthermore, episodes simulated including adsorption effects, indicated that the size of the polluted region is a direct function of the retardation factor, R sub d.
W83-03672

SOLUBILIZATION RATE OF ATMOSPHERIC PARTICULATE MATTER AND IMPACT ON WATER QUALITY,
Clemson Univ., SC. Dept. of Environmental Systems Engineering.
A. W. Elzerman, and T. J. Overcamp.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-243162, Price codes: A05 in paper copy, A01 in microfiche. Water Resources Research Institute Publication No 104, Clemson Univ., S. C., December 1982. 93 p, 22 Fig, 15 Tab, 111 Ref, 2 Append. OWRT A-049-SC(1), 14-34-001-0143, 9043, 1143.

Descriptors: *Air pollution effects, Aquatic environment, *Chemistry of precipitation, *Fate of pollutants, *Particulate matter, *Solubility, Acid rain, Air-water interface, Ammonium, Atmospheric water, Cadmium, Calcium, Iron, Kinetics, Leaching, Lead, Magnesium, Nitrates, Organic carbon, Phosphates, Potassium, Precipitation scavenging, Sodium, Sulfate, Trace metals, Solubilization, Aerosol solubility, South Carolina.

Although total atmospheric concentrations and wet and dry fallout mass loadings of numerous materials have been measured, understanding the ultimate fate of aerosols in aqueous systems requires knowledge of their post-deposition interactions. The major objective of this investigation was to determine the extent and rate of solubilization of aerosols. Samples collected on Nuclepore filters were extraced with various solutions in a pump-flow apparatus and the eluant analyzed in fractions. In Clemson, S. C., area samples tested, 30 to 60% of the total mass was soluble. Major soluble components (sulfate, ammonium, nitrate, calcium, hydrogen ion) and minor soluble components investigated magnesium, lead cadmium, manganese, phosphate, organic carbon) were released to solution quickly, more than half in 30 seconds and essentially all of the soluble fraction within 5 minutes. Extraction solution pH had little effect on most soluble components but increased the rate and extent of solubilization of lead. Lead oxide and lead nitrate behaved similarly to aerosols. The initial fate of soluble components of aerosols will be controlled by rapid dissolution.
W83-03677

FATE OF HERBICIDES IN GROUNDWATER AND SURFACE RUNOFF AND THEIR BIOTIC EFFECTS ON PRAIRIE POTHOLES,
North Dakota Univ., Grand Forks. Dept. of Biology.
L. E. Shubert.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-246371, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Institute Completion Report, North Dakota State Univ., Fargo, June 1983. 27 p, 4 Fig, 5 Tab, 66 Ref. A-074 NDAK(1), 14-34-0001-1136.

Descriptors: *Algae, *Aquatic plants, *Aquatic productivity, Artificial substrate, Habitats, *Periphyton, *Pothole, Primary productivity, Water quality, *North Dakota, Fox Lake, *Fate of pollutants, Water pollution effects, Saline lakes.

It has been well documented that prairie potholes comprise one of the best wetland habitats for waterfowl breeding on the continent. Since prairie potholes are closed ecosystems, they are important natural retention storage basins for spring and summer runoff from native grasslands and cultivated land. Thus potholes act as 'energy sinks' which reduce sediment and nutrient loading to streams and lakes. The purpose of this study was to determine periphyton productivity in Fox Lake, a prairie pothole, located in Ramsey County, 46 km west of Grand Forks, N.D. The chemical-physical characteristics of Fox Lake for 1981 demonstrated that it was alkaline, saline and moderately eutrophic. Submerged surface area for all three plant communities increased with time and correlated well with the seasonal pattern of aquatic plant production. Typha latifolia had the greatest production but not the highest submerged surface area. Phytoplankton showed an increase early and/or late in the season (diatom blooms), whereas the epiphytes on the rods were most abundant in the main part of the growing season (July - mid August). Grazing by zooplankton was particularly intense late in the season and was a major factor for a decrease in epiphyte biomass. The Potamogeton community epiphytes had the greatest photosynthetic activity, followed by the Typha and Scirpus communities. It was suggested that light was the most significant factor affecting productivity because the PAR light was highest at the Potamogeton site. Fox Lake is an excellent model for studying prairie potholes and periphyton production.
W83-03682

WATER QUALITY OF AIRPORT STORM RUNOFF, PHASE II,
Hawaii Univ. at Manoa, Honolulu. Water Resources Research Center.
G. L. Dugan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-246439, Price codes: A03 in paper copy, A01 in microfiche. Technical Report No 153, May 1983. 44 p, 6 Fig, 4 Tab, 14 Ref, 2 Append. OWRT A-086-HI(1), 14-34-0001-1113.

Descriptors: *Storm runoff, *Water supply, *Water quality standards, Water sampling, Pollutant identification, Nonpoint pollution source, Heavy metals, *Airports, Honolulu International Airport, General Lyman Field, Kahului Airport, Keahole Airport, Lihue Airport, *Hawaii.

The quality of natural and induced storm water runoff from several smaller public airports in Hawaii (air traffic volume of approximately 130 to over 350 airplanes/day) was compared to results from the previous Phase I study of the Honolulu International Airport that handles daily nearly 900 airplanes. The mean annual rainfall of these airports ranges from approximately 381 mm (15 in.) to nearly 3 251 mm (128 in.). Two basic storm quality monitoring schemes were incorporated: the wet season and the dry season. The wet-season monitoring involved collecting storm runoff samples from paved surfaces during and following rainfall events at a specific airport. The dry-season monitoring scheme consisted of enclosing a 0.25-m super 2 (2.69-ft super 2) area, applying deionized water, and then collecting the wash water, leached chemicals, and sediments by a hand bilge pump. As was the case for the storm runoff quality from the previous study of the Honolulu International Airport, the runoff from the smaller airports also contained mercury and turbidity that significantly exceeded the primary drinking water regulations, while concentrations of phenol and carbon chloroform extract definitely indicated that petroleum-derived products would be too high (expensive to remove) for consideration as an alternate drinking water supply. However, the water, if collected and stored, could serve as a source of subpotable water.
W83-03688

CURRENTS IN SOUTH SAN FRANCISCO BAY,
California Univ., Berkeley. Hydraulic Engineering Lab.
H. B. Fischer, and G. A. Lawrence.
California State Water Resources Control Board Publication No 83-2sp, January 1983. 327 p, 7 Fig, 6 Ref, 8 Append.

Descriptors: *Water currents, *Bays, *Tides, *Flow characteristics, *Hydrologic data collections, *Current meters, Tidal currents, Neap tides, Spring tides, Salinity, Water temperature, Water pollution effects, Synoptic analysis, Flow profiles, Flushing, *San Francisco Bay.

During 1978-81, the U.S. Geological Survey and the National Ocean Survey made intensive field measurements of currents, salinity, and temperature at 34 stations in San Francisco Bay. This report describes describes the currents in a way useful to pollution and ecologically related studies; hydrodynamic transport is one link in the chain of input, transformation, accumulation and effects of pollution. Three levels of processing and archiving data were used: level one data were averaged into 30-minute blocks, placed in standard form, and time sequence, progresive vector, and current rose plots were drawn; in level two, the data were averaged to create a typical 25-hour tidal cycle with an emphasis on preserving the length and direction of the tidal excursion using progressive vectors; in level three, plots were prepared that showed typical tidal cycle motions and current distributions in the bay. Characteristic cycles were obtained for neap, spring, and 14-day mean conditions. Inconsistent or known defective data were discarded. The results were mostly consistent with theoretical predictions. The flow is generally back and forth in the direction of the main axis of the bay, almost independent of crossectional location. Tidal excursions range from about 6 km at shallow stations to 12-20 km in the deeper ones, and tidal-averaged distribution corresponded to the prevailing easterly wind. These data provide a base for further analyses of flushing mechanisms—how much new water is available to dilute pollutants and/or supply nutrients. Suggestions are given for further work to complete the transport modelling, i.e. gravitational overturn, variation of daily mean, and salinity-velocity correlations. (Atkins-Omniplan)
W83-03690

MOVEMENT OF BACTERIA THROUGH MACROPORES TO GROUND WATER,
Kentucky Water Resources Research Inst., Lexington.
M. Smith, G. W. Thomas, and R. E. White.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-246546, Price codes: A03 in paper copy, A01 in microfiche. Research Report No 139, June 1983. 38 p, 11 Fig, 5 Tab, 18 Ref. OWRT A-088-KY(1), 14-34-0001-2119.

Descriptors: Soil filters, Soil columns, Soil water, Soil properties, *Soil bacteria, *E. coli, *Path of pollutants, Soil moisture, Soil type, Soil profiles.

Effects of soil type, flow rate, antecedent soil moisture and other factors on transport of E. coli through soils was measured on disturbed and intact columns 20 cm in diameter by 25 to 30 cm in depth. Added E. coli were distinguished from indigenous microbes using an antibiotic resistance marker. Transport of Cl super - and super 3 H sub

2 O was also measured. Up to 96% of the bacteria irrigated onto the surface of intact columns were recovered in the effluent. Soil structure appeared to be related to the extent of transport. Columns prepared from mixed, repacked soil were much more effective bacterial filters than the intact soils. As rate of water input increased, the fraction of E. coli recovered in the effluent increased. We concluded that flow through soil macropores, which by-passes the adsorptive or retentive capacities of the soil matrix is a common phenomenon. This conclusion was supported by the behavior of Cl super - and super 3 H sub 2 O. In waste disposal systems dependent on purification in the soil profile, this could significantly increase the probability of ground-water contamination by microbes. The effect of native soil structure (macropores) must be considered in the evaluation of these purification systems.
W83-03705

KINETICS OF PHOSPHORUS UPTAKE IN THE CHOWAN RIVER, NORTH CAROLINA,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
K. L. Stone.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-246959, Price codes: A05 in paper copy, A01 in microfiche. M. S. Thesis, 1982. 96 p, 23 Fig, 10 Tab, 83 Ref. OWRT B-127-NC(11), 14-34-0001-0275.

Descriptors: *Phosphorus, *Kinetics, *Phytoplankton, *Cyanophyta, *Eutrophication, *Cycling Nutrients, Rivers Seston, Algae, Nuisance algae, Limiting nutrients, Nitrogen, Seasonal variation, Chlorophyll A, Radioactive tracers, Phosphorus radioisotopes, Turnover time, Particle size, Bacteria, Light intensity, Water temperature, Hydrogen ion Concentration, *North Carolina, Chowan River.

Gross biotic uptake rates of filterable reactive phosphorus by plankton were measured in surface waters of the Chowan River from May 1980 to October 1981. Uptake rates varied widely, ranging from 0 to 6.15 mu M . h super -1, and were greater in the warmer months in the middle and lower reaches of the river. Abiotic phosphate uptake rates and ranged from 0.001 to 0.63 mu M . h super -1. Rapid biotic uptake coincided with low filterable reactive phosphorus concentrations and high levels of chlorphyll-a. Size fractionation of the uptake indicated that most of the uptake occurred in particles with dimensions less than 8.0 mu M. Phosphorus uptake rates and turnover times were good indicators of the phosphorus nutritional status of phytoplankton in the Chowan River. The plankton were often phosphorus limited during the summer months in the middle and lower river. Phosphorus uptake kinetics were discussed in relation to the occurrence of surface blooms of bluegreen algae and the relative abundance of nitrogen and phosphorus. Implications of phosphorus uptake kinetics in selecting appropriate management practices were also presented.
W83-03711

NITROGEN FIXATION AND DENITRIFICATION IN THE PAMLICO RIVER, NORTH CAROLINA,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
G. S. Allgood.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-246967, Price codes: A05 in paper copy, A01 in microfiche. M. S. Thesis, 1983. 97 p, 9 Fig, 15 Tab, 67 Ref. OWRT B-144-NC(1), 14-34-0001-1257.

Descriptors: *Nitrogen fixation, *Denitrification, *Sediments, Bottom water, Rivers, Estuaries, Nitrogen, Nitrogen cycle, Nitrate, Ammonia, Carbon, Seasonal variation, *Acetylene reduction, *North Carolina, Pamlico River, *Pollutant identification, Water pollution sources.

Rates of nitrogen fixation in the sediment of the Pamlico River were measured from February 1982 to February 1983 using the acetylene reduction technique. Nitrogen fixation rates vied from 0.5 to 11.7 mu moles N2/m super 2hr and were greatest in the summer and late fall. Rates were shown to increase with increasing temperature, additional carbon substrate, and increasing concentration of acetylene incubated in the headspace. Furthermore, nitrate addition generally decreased rates, or had no effect, while ammonia addition decreased rates at the downriver station but had no effect at the upriver station. Rates of nitrogen fixation were found to be equal to the ammonia flux out of the sediment in winter, but were only five percent or less of the flux in the summer. Nitrogen fixation in the Pamlico River is probably limited by temperature in the winter and by a variety of factors in the summer, including availability of carbon and nitrogen. Rates of denitrification were measured from July 1982 to March 1983 using the acetylene blockage technique. Denitrification rates were not measurable unless nitrate was added, and were as large as 479 mu moles N sub 2/m super 2hr with 119 mu M nitrate added. Denitrification capacity was greatest during the winter when as much as 9.8% of added nitrate was used for denitrification. Denitrification in the Pamlico River sediments appears to be limited by the availability of nitrate.
W83-03712

THE EFFECTS OF BOTTOM WATER ANOXIA ON BENTHNIC NUTRIENT FLUX RATES IN THE PAMLICO RIVER,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
For primary bibliographic entry see Field 5C.
W83-03713

A STUDY OF RADIUM-226 AND RADON-222 CONCENTRATION IN GROUND WATER NEAR A PHOSPHATE MINING AND MANUFACTURING FACILITY WITH EMPHASIS ON THE HYDROGEOLOGIC CHARACTERISTICS OF THE AREA,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
B. F. Mitsch.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-246983, Price codes: A06 in paper copy, A01 in microfiche. M. S. Thesis, 1982. 116 p, 38 Fig, 8 Tab, 33 Ref, 2 Append. OWRT B-145-NC(1), 14-34-0001-1258.

Descriptors: Groundwater, *Radioactivity, *Groundwater pollution, Geohydrology, Phosphates, *Mine drainage, Aquifers, Aquitards, Gamma radiation, Pumping, Drawdown, Leakage, Dewatering, Beneficiation, Gypsum, Uranium, *Kadium-226, *Radon-222, *North Carolina, Castle Hayne aquifer.

Samples of water from wells located near a phosphate mining and manufacturing facility were collected and analyzed for Radium-226 and Radon-222. Chemical separation and emanation techniques were utilized in the analyses. Results indicated that mining and manufacturing were not having a detrimental effect on the radionuclide concentrations in the ground water of the area. Natural hydrogelogic factors can account for the differences in radioactivity observed in the various aquifers sampled. Wells sampled repetitively over time did not exhibit any significant changes in radium or radon concentrations. Baseline data were established which can be used to evaluate possible future impacts on radio-nuclide concentrations in ground water resulting from expansion of mining activities.
W83-03714

SALT TRANSPORT IN THE LOWER SOUTH PLATTE RIVER,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
R. V. Gomez-Ferrer, and D. W. Hendricks.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-249599, Price codes: A09 in paper copy, A01 in microfiche. Environmental Engineering Technical Report No 82-3141-01, Colorado State Univ., Fort Collins, January 1982. 167 p, 59 Fig, 25 Tab, 41 Ref,

Descriptors: *Salinity, *Salt balance, *Irrigation effects, Irrigation water, Dissolved solids, Water resources development, South Platte River, *Colorado, *Path of pollutants, Water pollution sources.

This work demonstrates how river salinity may be characterized, in terms of both time and space variations. Fifteen years of daily and monthly salinity and flow data have been reduced to monthly, seasonal, and annual statistical characterizations for five river stations and three tributary stations for the lower South Platte River. From these characterizations distance profiles were plotted for flow, TDS, and salt mass flows. point source discharges were the basis for a reach-by-reach materials balance analysis for four reaches of the South Platte River between Henderson and Julesburg. Return flows and return salt mass flows were computed as residuals. The analysis showed that there is not a salt balance in the lower South Platte River. A net salt loss to the land of 380 tons per day occurs by irrigation. The analysis provided can be the basis for a more comprehensive materials balance model. But the results can be used to estimate the impact of new water resources developments upon the salinity regime of the lower South Platte River.
W83-03718

AN INVESTIGATION OF THE CHEMISTRY OF DEGRADATION OF PESTICIDES AND OTHER SERIOUS ORGANIC CONTAMINANTS IN DRINKING WATER FOR APPLICATION TO DOMESTIC AND COMMUNITY WATER SUPPLIES,
New York State Coll. of Human Ecology, Ithaca. Dept. of Design and Environmental Analysis.
For primary bibliographic entry see Field 5F.
W83-03725

EFFECT OF SEEPAGE FROM UNLINED MUNICIPAL WASTE STABILIZATION LAGOONS ON CHEMICAL QUALITY OF GROUNDWATER IN SHALLOW AQUIFERS,
North Dakota Univ., Grand Forks. Dept. of Geology.
A. E. Kehew, D. J. Brown, and F. J. Schwindt.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-248336, Price codes: A09 in paper copy, A01 in microfiche. North Dakota Water Resources Research Institute Completion Report, North Dakota State University, Fargo, December 1982. 183 p, 36 Fig, 3 Tab, 34 Ref, 6 Append. OWRT A-072-NDAK(1), 14-34-0001-1136.

Descriptors: *Groundwater, *Impoundments, *Lagoons, *Seepage, Aquifers, Coliforms, Water pollution, Sludge, Ammonium compounds, Adsorption, *North Dakota, *Stabilization lagoons, Path of pollutants.

Groundwater quality changes were investigated around six unlined municipal waste stabilization lagoons in North Dakota. The lagoons chosen were constructed in permeable sediments directly over shallow, unconfined aquifers. Groundwater contamination at all sites is characterized by a plume of water with low redox potential and high dissolved-solids content extending downgradient from the impoundments. At McVille, the site with the most severe contamination, untreated wastewater is maintained in one cell throughout the year except when short intermittent discharges of wastewater are made into an adjacent cell. Groundwater quality is much poorer downgradient from the intermittently-used cell relative to groundwater just downgradient from the primary cell. Seepage water quality is apparently better when adequate holding time is maintained in a cell with a basal slude layer. Water downgradient from the intermittently-used cell has a very high ammonium concentration, which is subsequently decreased by adsorption. Evidence suggests that coliform organisms can move several hundred feet away from the lagoons in groundwater under favorable conditions. Contamination at the other sites was not as severe as McVille although levels of some parameters exceed drinking water standards in the vicinity of the lagoons. Lagoons in geological settings similar to the study area should be lined, particularly if wells are nearby.
W83-03731

SIMULATION OF NUTRIENT, MICROORGANISM, AND HEAVY METAL TRANSPORT CAPACITY OF SUSPENDED SEDIMENT,
Arizona Univ., Tucson. School of Renewable Natural Resources.
For primary bibliographic entry see Field 2J.
W83-03732

METAL SURVEYS IN SOUTH AFRICAN ESTUARIES V. KROMME AND GAMTOOS RIVER (ST. FRANCIS BAY),
Port Elizabeth Univ. (South Africa). Dept. of Zoology.
R. J. Watling, and H. R. Watling.
Water SA, Vol 8, No 4, p 187-191, 1982. 3 Fig, 3 Tab, 8 Ref.

Descriptors: *Estuaries, *Trace metals, *Water pollution sources, Pollutant identification, Zinc, Cadmium, *South Africa, Gamtoos River, Kromme River, St. Francis Bay, Copper, Lead, Iron, Manganese, Nickel, Cobalt, Mercury, Sodium, Potassium, Cadmium, Magnesium.

During August of 1979 surveys were made to study the distribution of selected metals in the Kromme and Gamtoos Rivers. Water samples were analyzed for thirteen elements, and surface sediments core samples were examined for sixteen elements using atomic absorption spectroscopy. The distribution of metals in water, surface sediment and sediment core samples indicates that both rivers drain essentially unpolluted catchments. However, unusually high metal inputs were found at isolated sites in each river. Trace toxic metals are introduced into the Kromme River via the Geelhoutboom tributary as a result of the weathering of a local mineralized sequence. The effects of this input are distinguishable as far as the midstream island at the confluence of the two rivers. No anomalous metal levels are easily discernible downstream of this site. Anomalously high concentrations of manganese, copper, zinc, and iron were found in the region of the Gamtoos River mouth and nearby lagoon. These may be related to a combination of the use of certain agricultural products in the cultivated area of the flood plain and physico-chemical phenomena occurring in the upper lagoonal area. Surface water runoff would account for their presence in the water column, after which the usual sedimentary processes could cause their deposition at particular sites downstream. Overall metal levels in the Gamtoos River are slightly higher than those in the Kromme River. (Baker-FRC)
W83-03738

METAL SURVEYS IN SOUTH AFRICAN ESTUARIES VI. SUNDAYS RIVER,
Port Elizabeth Univ. (South Africa).
R. J. Watling, and H. R. Watling.
Water SA, Vol 8, No 4, p 192-195, 1982. 1 Fig, 3 Tab, 3 Ref.

Descriptors: *Estuaries, *Metals, *Pollutant identification, Sediments, Mineralization, Zinc, Mercury, Manganese, Copper, Lead, Cobalt, Nickel, Chromium, Cadmium, Iron, Sundays River, *South Africa.

The distribution of selected metals was examined in the Sundays River during August 1979 and 1981. Surface sediment and water sample and sediment cores were analyzed for up to 16 elements using atomic adsorption spectroscopy. The findings indicate that the input of metals by man is insignificant. The increased levels of metals in the sediment column are probably derived from catchment weathering of mineralized zones, and metals are likely to be present in the stable sulfide form, making them relatively unavailable to the biota. The Sundays River is at present unpolluted with respect to metals, and unless further urban, agricultural, or industrial developments take place it should not be necessary to monitor the area. (Baker-FRC)
W83-03739

FACTORS INFLUENCING DIELDRIN AND DDT RESIDUES IN CARP FROM THE DES MOINES RIVER, IOWA, 1977-80,
Iowa Cooperative Fishery Research Unit, Ames.
W. H. Hubert, and E. D. Ricci.
Pesticides Monitoring Journal, Vol 15, No 3, p 111-116, December, 1981. 3 Fig, 3 Tab, 17 Ref.

Descriptors: *Pesticide residues, Fish, Fate of pollutants, *Dieldrin, *DDT, Insecticides, *Carp, Rivers, Reservoirs, Seasonal variation, Des Moines, *Iowa.

Carp from the Des Moines River, Iowa, were analyzed for dieldrin and DDT residues in 1980. Dieldrin levels were 10-128 micrograms per kg of flesh and 630-5790 micrograms per kg of fat. Differences in mean levels were statistically different among the 4 stations, with a tendency to higher levels at the 2 reservoir stations than at the river stations. Mean levels of dieldrin in fat and flesh declined from June to September. Total DDT levels were 18-191 micrograms per kg of flesh and 1090-9910 micrograms per kg of fat. Although the mean DDT levels were significantly different at the stations, there was no clear pattern with respect to reservoir vs. river samples. Mean levels of total DDT declined from June to September. (Cassar-FRC)
W83-03743

1,2-DIBROMO-3-CHLOROPROPANE RESIDUES IN WATER IN SOUTH CAROLINA, 1970-80,
Clemson Univ., SC. Dept. of Plant Pathology and Physiology.
G. E. Carter, Jr.,, and M. B. Riley.
Pesticides Monitoring Journal, Vol 15, No 3, p 139-142, December, 1981. 4 Fig, 1 Tab, 5 Ref.

Descriptors: *Pesticide residues, *Nematocides, *Fumigants, *South Carolina, Water analysis, Fate of pollutants, 1,2-Dibromo-3-chloropropane, Soil fumigants, Path of pollutants.

The soil fumigant and nematocide, 1,2-dibromo-3-chloropropane (DBCP), was determined in well water, surface water and muncipal water samples from 3 regions in South Carolina: Piedmont, no DBCP use; Sandridge, high DBCP use; and coastal, scattered DBCP use. Samples from the Piedmont contained a background level of DBCP, up to 0.05 ppb. In the coastal area DBCP levels in well water and municipal water samples did not exceed the background level; one surface water sample contained about 0.2 ppb. In the Sandridge area municipal water samples contained the background level of DBCP. 27% of the well water samples exceeded the background level. Of these, several from one small area exceeded 1 ppb DBCP. 37% of surface water samples from Sandridge exceeded the background level, but none were higher than 0.4 ppb. (Cassar-FRC)
W83-03744

THE NITROGEN BALANCE OF VEGETABLE CROPS IRRIGATED WITH UNTREATED EFFLUENT,
Chile Univ., Santiago. Dept. of Inorganic and Analytical Chemistry.
B. E. Schalscha, and F. I. Vergara.
Plant and Soil, Vol 67, No 1-3, p 221-226, 1982. 4 Tab, 11 Ref.

Descriptors: *Nitrates, *Wastewater irrigation, Nitrogen removal, Agriculture, Santiago, *Chile, Irrigation water, Fate of pollutants, Fertilizers.

Agricultural fields irrigated with untreated effluent from the sewers of Santiago, Chile, received 779 kg N per ha during a recent year. Of this, lettuce, spinach beet, and celery crops removed 161, 223, and 287 kg N per ha, respectively. Much of the excess N apparently migrates to the groundwater (water tables, 1-15 m deep in this region) as nitrate, since well water samples impacted by the effluent showed nitrate levels of 16.5 and 11.5 mg per liter. Total N in treated soil varied with depth from 0.02% at 70 cm and deeper to 0.28% in the upper 30 cm. Control soil contained only 0.06% N throughout its depth. (Cassar-FRC)
W83-03745

RATE OF DENITRIFICATION IN WATER BODIES OF AN IRRIGATION SYSTEM AND SOIL OF RICE FIELDS IN THE KARA KALPUK ASSR,
I. N. Krylova, and T. R. Babanazarov.
Water Resources (English Translation), Vol 9, No 2, p 199-203, March-April, 1982. 6 Tab, 8 Ref. Translated from Vodnye Resursy, No 2, p 116-121, March-April, 1982.

Descriptors: *Denitrification, *Irrigation practices, Rice, Floods, Lakes, Fertilizers, Phosphates, Nitrogen, Nitrates, Ammonium sulfate, *USSR, Kara Kalpuk ASSR.

The agrochemical and microbiological characteristics and results of determinations of the activity of biological denitrification in the bottom sediments of the water bodies of the irrigation system and soils of rice fields are presented. Field experiments were conducted during July and August of 1979 and May to July of 1980. One of the study fields was strongly saline field, where rice was sown for the first time. The second field was in the eighth year of use. Before sowing rice, 500 kg of superphosphate and 700 kg of ammonium sulfate were applied per hectare. During the growing season 200 kg of ammonium sulfate per hectare was applied additionally. The total amount of nitrogen applied was 191 kg/ha. The water layer in the paddies was kept at the level of 15-20 cm. Soil samples for analysis were taken from various horizons to a depth of 10 cm at two points. The nitrogen content changes most substantially after flooding the soil of the rice fields. Thus, a deficit of nitrogen-containing substances was formed under reducing conditions in sulfate-calcareous soil, where the total nitrogen content dropped from 2.37 to 0.78 mg N/g dry soil, and also in the rhizosphere of rice in calcareous soil, where it decreased from 3.70 to 1.44 mg N per g dry soil. On the basis of analyses of the activity of microbiological processes it was calculated that during the growing season about 8 kg N/ha is denitrified on calcareous soil and about 44 kg N/ha sulfate-calcareous soil, which is equal respectively to 4 and 23% of the amount of nitrogen applied to the fields with fertilizers. However, in sulfate-calcareous soil rich in active cations the total nitrogen increases due to washing out of nitrates and ammonium. The rate of denitrification in water bodies of the irrigation system is comparable to that in soils of the rice fields. Denitrification attains maximum activity in peripheral lakes. (Baker-FRC)
W83-03760

SALT STATUS OF GLACIAL TILL SOILS OF NORTH-CENTRAL MONTANA AS AFFECTED BY THE CROP-FALLOW SYSTEM OF DRYLAND FARMING,
Montana Agricultural Experiment Station, Bozeman.
For primary bibliographic entry see Field 2G.
W83-03769

ANIMAL FEEDLOT RUNOFF IN THE PIEDMONT,
Clemson Univ., SC. Dept. of Agricultural Engineering.
R. O. Hegg, C. L. Barth, and W. H. Hanvey.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-248393, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Institute Report No 109, July 1983. 28 p, 4 Fig, 4 Tab, 20 Ref, 3 Append. OWRT B-126-SC(1), 14-34-0001-9133.

Descriptors: *Surface runoff, Runoff volume, *Feedlot runoff, Animal wastes, Rainfall intensity, *Erosion, Runoff, *Rainfall-runoff relationships, Settling basins, *South Carolina, Piedmont region.

Animal feedlots are characterized by compacted soils and a lack of vegetation. In the South Carolina Piedmont Region high annual rainfalls (55 in/yr) on the animal feedlots can cause polluted water to enter streams and lakes. This three year study was conducted at a 10.19 acre feedlot at the Clemson University Simpson Experiment Station. A sampling station was constructed to measure the

quantity and quality of the runoff from the feedlot. A majority of the rainfall intensities ranged from 0.01 to 0.2 in/hr, but with the maximum reaching 0.6 in/hr. There was a wide variability in the percentage of the rainfall leaving the feedlot as runoff (0 - 90%) which was due to the rainfall duration, rainfall intensity, vegetation cover and preceeding moisture conditions. The average sediment loss from eleven storms when there were no animals on the feedlot was 5.4 lbs/ac and from 35 storms with animals on the feedlot the average was 20.3 lbs/ac. Both of these values are quite low and would cause no serious erosion problems on slopes of 2 - 5% at the animal stocking rates(4000-9000 ft super 2/hd) encountered in this study. There was a wide range in the water quality characteristics of the runoff. Typical average values by storm were as follows pH:, 6.5-7.2; total coliform bacteria, 6E5-3E7 (colonies/100ml); fecal coliform, 0.2E6 (colonies/100ml); TOC, 4-900; total kjeldahl nitrogen, 2-30; TP, 1-50; COD, 30-1400; FS, 300-3400; VS, 200-2000; nitrate -N, 0.2-10 and ammonia-N, 1-10 (all as mg/L unless otherwise noted).
W83-03775

TRICKLE IRRIGATION - MODELING WATER AND SOLUTES,
Arizona Univ., Tucson. Dept. of Mathematics.
For primary bibliographic entry see Field 2G.
W83-03777

PLASTIC PELLETS ON SPAIN'S 'COSTA DEL SOL' BEACHES,
Shiber Consultants, Safat (Kuwait).
J. G. Shiber.
Marine Pollution Bulletin, Vol 13, No 12, p 409-412, December, 1982. 2 Fig, 2 Tab, 23 Ref.

Descriptors: *Water pollution sources, *Industrial wastes, *Plastic industry, Plastic, Costa del Sol, *Spain, Polyethylene.

Plastic pellets were found on the beaches of the Costa del Sol of Spain. The pellets were primarily of the low density polyethylene type. Some degradation was noted. The rest of the pellets were either high density polyetylene or ethylvinyl acetate. None was polystyrene. The largest accumulation probably occurs during the winter months when the beaches are more or less neglected and the sea is most turbulent. In Estepona, the pellets were most abundant at the end of November 1980 after a few winter storms had occurred. At least seven plastic factories operate in the vicinity of the Costa del Sol. Careless disposal practices of these factories or losses of raw materials during sea shipment or unloading at ports are possible and very likely sources of this pollutant. The absence of crazing and encrusting biota on the pellets suggests that their introduction to this environment was relatively recent. (Baker-FRC)
W83-03785

FACTORS AFFECTING THE SOLUBLE-SUSPENDED DISTRIBUTION OF STRONTIUM-90 AND CESIUM-137 IN DARDANELLE RESERVOIR, ARKANSAS,
Arkansas State Univ., State University. Dept. of Chemistry.
D. M. Chittenden, II.
Environmental Science and Technology, Vol 17, No 1, p 26-31, January, 1983. 2 Fig, 4 Tab, 18 Ref.

Descriptors: *Radioisotopes, *Sediments, *Reservoirs, Fate of pollutants, Radioactive wastes, Strontium radiosotopes, Cesium radioisotopes, Suspended sediments, Bottom sediments, Dardanelle Reservoir, *Arkansas, Powerplants, Nuclear reactors, Adsorption, Clays.

Concentrations of Sr90 and Cs137 were determinded in suspended and bottom sediments from the Dardanelle Reservoir, Arkansas, used as a cooling water source by a nuclear powerplant. Analysis of the levels of radionuclides with respect to the concentration of ionic species and the radioactivity released from the plant showed that the sorbed Sr90 level had an inverse relationship to the concentration of alkaline earth cations. The main source of the Sr90 (0.50 pCi per liter) was fallout rather than releases from the reactors. This radionuclide has been in the system long enough to reach equilibrium between solution and suspended sediments. Bottom sediments had slightly higher Sr90 concentrations than suspended sediments. The concentration of Cs137 was dependent on total activity released from the reactors. An equilibrium between sorbed and dissolved Cs137 has not been reached in the reservoir because there is constant input from the reactors and the required time for reaching equilibrium is greater than the residence time in the reservoir. (Cassar-FRC)
W83-03795

SOURCES OF TRIHALOMETHANES AND OTHER C1 AND C2 HALO-ORGANICS IN POTABLE WATER,
For primary bibliographic entry see Field 5F.
W83-03799

CU, CD AND ZN IN BLANCA BAY SURFACE SEDIMENTS, ARGENTINA,
Instituto Argentino de Oceanografia, Buenos Aires. Lab. de Quimica Marina.
J. L. Sericano, and A. E. Pucci.
Marine Pollution Bulletin, Vol 13, No 12, p 429-431, December, 1982. 4 Fig, 2 Tab, 4 Ref.

Descriptors: *Sediments, *Metals, *Bays, Surface sediments, Copper, Zinc, Cadmium, Blanca Bay, *Argentina, Water pollution sources, Fate of pollutants.

Evaluations were made of contamination of seawater and surface sediments of Blanca Bay caused by industrial activity and urban centers in this region. Concentrations and distributions of copper, cadmium and zinc in these sediments that correspond to the NW limits of Blanca Bay are reported, along with the textural character of these sediments. Reference values were sought to be used in the future to measure the changes produced by an increase in contamination. Water drained from almost 4200 sq km of cultivated land plus the urban wastes of nearly 300,000 inhabitants of Bahia Blanca with a large industrial zone are discharged directly to the seawater. The area behaves as an estuary in periods of heavy rainfall. In general, spatial variations were found in the concentrations of the trace metals at each station from one cruise to another. Some of the variations indicate a clear influence from two important contaminating centers, the municipal garbage dump and the emptying of the main sewer of Bahia Blanca. Sampling stations located in places far away from the urban centers showed a more uniform distribution of values. The relationship between metal contents and pelitic percentages in the Blanca Bay area indicates a direct correlation for copper and zinc. Surprisingly high values of copper and zinc were present in low percentage pelite sediments. Cadmium showed no clear correlation with sediment texture. The average levels for these three metals found in the surface sediments from Blanca Bay are considerably lower than those found in estuaries and bays located in other geographic regions. (Baker-FRC)
W83-03802

HEAVY METAL DISTRIBUTION IN SEDIMENTS FROM THE GULF OF CATANIA (ITALY),
Catania Univ. (Italy). Ist. di Biologia Generale.
A. Castagna, F. Sarro, F. Sinatra, and E. Console.
Marine Pollution Bulletin, Vol 13, No 12, p 432-434, December, 1982. 6 Fig, 1 Tab, 8 Ref.

Descriptors: *Sediments, Metals, *Gulfs, Gulf of Catania, *Italy, *Path of pollutants, Chromium, Copper, Cadmium, Zinc, Lead, Rivers, Simeto River, San Leonardo River, *Heavy metals.

Samples from 39 stations were tested for heavy metal distribution in the sediments of the Gulf of Catania. For zinc, chromium, lead, and copper there were strips of similar concentrations running parallel to the coastline, with values increasing proceeding from the shore out to sea. The majority of the area investigated has metal concentrations within the normal range for unpolluted areas, except for certain zones where a specific type of hydrography was caused by the waste water drains of the metalworking factories which enter the sea either directly or through the river Simeto. The stretch of sea studied is characterized by a current flowing southwards from the strait of Messina which, at the level of Capo S. Panagia, moves out to sea in the direction of the Sicilian channel. The presence of this current sets up a countercurrent flowing from south to north just off the coast. This countercurrent carries solid matter toward the port of Catania, which is thus subject to silting. Two rivers, Simeto and San Leonardo, enter the sea along the Catania Plaia beach, and thus transport sedimentable solids that contribute to this problem. As a result of hydrodynamic thrust, the clayey mass coming from the river goes out to sea and forms sediments. (Baker-FRC)
W83-03803

SILICONES IN CHESAPEAKE BAY SEDIMENTS,
Naval Research Lab., Washington, DC.
R. E. Pellenbarg.
Marine Pollution Bulletin, Vol 13, No 12, p 427-429, December, 1982. 1 Fig, 1 Tab, 6 Ref.

Descriptors: *Sediments, *Silicones, *Water pollution sources, *Fate of pollutants, Precipitation, Flocculation, Chesapeake Bay, Dispersion.

The dispersal of silicones in a large spatial context was investigated using a suit of sedimentary samples from the Chesapeake Bay. In the upper reaches of the Chesapeake Bay, sedimentation appears widespread, though sedimentation is often most concentrated at shoal locations. These are shore regions in the southern bay, so that sedimentary silicone is highest at the end stations of the down bay transects. The Chesapeake Channel, running along the axis of the Bay from near Annapolis to the bay mouth, accumulates neither organic-rich sediments nor silicones. The transect where the shallow upper bay gives way to the channel may be likened to the shelf-beak seen as one leaves a sea coast for deep waters. This is an area of high sedimentation, a process which could tend to homogenize and trap silicones moving downstream from such sources as Baltimore. Alternatively, materials from the Annapolis region would easily settle out in the general region of the transit. Urban influences are not clearly shown in this study. Thus there were two major trends. First, sedimentary silicones respond to physicochemical processes affecting other components of the sediment system. The major process may be flocculation of silicone-bearing particles. Second, it appears that the processes which remove silicone-bearing materials from the water column may be quite rapid. Silicones from Chesapeake Bay sediments do not definitely appear to have migrated from more diffuse source areas. (Baker-FRC)
W83-03804

2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN IN SEDIMENT SAMPLES FROM LOVE CANAL STORM SEWERS AND CREEKS,
New York State Dept. of Health, Albany.
For primary bibliographic entry see Field 5A.
W83-03814

EVALUATION OF ACID-MINE-WATER GENERATION AND ACID-MINE-DRAINAGE POTENTIAL OF COAL AND COAL-ASSOCIATED ROCKS,
West Virginia Univ., Morgantown. Water Research Inst.
J. J. Renton.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-253328, Price codes: A02 in paper copy, A01 in microfiche, Completion Report, August 1983. 7 p. A-044-WVA(1), 14-34-0001-2152.

Descriptors: *Acid mine drainage, Geochemistry, *Land reclamation, *Pyrite, *Sulfides, *Water pollution sources, Chemical properties, Chemical Reactions, Iron compounds, Management planning,

Mine Drainage, Mine wastes, Mineralogy, Strip mine wastes, Sulfur compounds, *West Virginia.

Control or prevention of the drainage of acid mine water into streams is perhaps the greatest water problem in West Virginia and in the coal-mining areas of the region. After many years and much effort, the basic characteristics of the material, generally accepted as pyrite, that yields the acid are still not adequately understood. Planning, management, and control of this toxic pollutant are hindered without a sufficient understanding of the mechanisms of acid formation. This project was a small part of a continuing research effort of the principal investigator to gain a sufficient understanding of the mechanisms of mine-acid formation. A single 24-hour leaching of acid-producing materials yields an acid load of the same relative magnitude as extended leaching-reoxidation cycles. The best parameter for estimating acid yield is total-rock iron, followed by total-rock sulfur. For greater than half an inch, particle size appears not to influence the rate of acid yield; below that, yield increases exponentially decreasing size. The most reactive morphological form of pyrite is the massive variety; not the framboidal.
W83-03820

POLLUTANT LOADING MODEL FOR HIGHWAY RUNOFF,
Systems Architects Engineers, Inc., Seattle, WA.
T. W. Chui, B. W. Mar, and R. R. Horner.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 108, No EE6, p 1193-1210, December, 1982. 4 Fig, 11 Tab, 24 Ref.

Descriptors: *Water pollution sources, *Fate of pollutants, *Storm runoff, Model studies, *Pollution load, *Highway effects, Storm water, Urban runoff, Storms, Pollutants, Environmental effects, Suspended solids, *Washington.

Data from composite sampling of about 500 storm events at nine locations in Washington State were used to formulate a stormwater runoff pollutant loading model to describe the mechanisms of highway and traffic pollution of stormwater runoff. The model incorporates an expression relating total suspended solids (TSS) load to motor vehicle traffic, runoff coefficient, and surrounding land use contributions. Other contaminants such as volatile suspended solids, chemical oxygen demand, total organic carbon, total Kjeldahl nitrogen, nitrate, nitrite, total phosphorus, copper, zinc and lead are estimated from TSS load using load ratios derived from the data. These ratios may be taken as constants at any Washington state location for some pollutants or as a linear function of traffic volume for others. The model is useful in forecasting cumulative pollutant loadings in runoff from highways constructed in locations where climatic, soil, and land use conditions are similar to those at the sampling sites used to construct the data base. It is capable of predicting loadings over a time span encompassing a number of storms, but has little precision when applied to individual storm events. (Geiger-FRC)
W83-03829

COASTAL POLLUTION FROM SEPTIC TANK DRAINFIELDS,
North Carolina Dept. of Natural Resources and Community Development, Raleigh.
A. M. Duda, and K. D. Cromartie.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 108, No EE6, p 1265-1279, December, 1982. 5 Fig, 3 Tab, 17 Re f.

Descriptors: *Septic tanks, Tidal basins, *Coastal zone management, *Water pollution sources, *Coliforms, *Viruses, Septic wastewater, Tidal flats, Tidal rivers, Tide lands, Coastal waters, Shellfish, *North Carolina.

Bacterial and viral contamination of the coastal waters of North Carolina, a major shellfish harvesting area, has become a great concern in recent years due to the increase in residential communities with septic tank systems. The densities of coliform bacteria in six tidal watersheds draining residential areas of coastal North Carolina were monitored by wet and dry weather sampling techniques. Bacterial levels were compared with those of unsewered residences in each watershed. The ability of developed soils to assimilate septic tank effluents was also taken into account. Statistical analysis of the data implicated septic tank drainfields installed in unsuitable soils as a major source of contamination of coastal shellfish waters. Several common sense management practices were recommended to reduce the risk of further pollution. It was suggested that sufficient rural areas be maintained in each watershed to provide dilution water to allow easier assimilation of pollutant loads, that pollution sources be prevented from intermingling with tidal creeks, and that only properly functioning septic systems be allowed to function within coastal areas. (Geiger-FRC)
W83-03836

AGRICULTURE AND WATER QUALITY IN THE CANADIAN GREAT LAKES BASIN: III. PHOSPHORUS,
Guelph Univ. (Ontario). Dept. of Land Resource Science.
M. H. Miller, J. B. Robinson, D. R. Coote, A. C. Spires, and D. W. Draper.
Journal of Environmental Quality, Vol 11, No 3, p 487-493, 1982. 3 Fig, 4 Tab, 19 Ref.

Descriptors: *Phosphorus, *Great Lakes, *Agricultural watersheds, Watersheds, Fate of pollutants, Water pollution sources, Nonpoint pollution sources, Pollution loads, Ontario, Water quality, Streams, Farm management, Runoff, Agricultural runoff, Erosion, Clays, Livestock, Farm wastes, Animal wastes.

Phosphorus contributions to the Great Lakes from agricultural activities in the Canadian basin were determined, using data from 1975-76, by two methods: (1) relating measured P loads at the outlets of 10 representative watersheds to land characteristics and agricultural activities, and (2) estimation of contributions from cropland runoff, livestock runoff, unimproved land runoff, and streambank erosion from studies of each source. Percent clay in the surface soil and the proportion of the area in row crops accounted for 85% of the variability in total P unit area loads from the watersheds. Dissolved reactive P unit area loads were related to clay content of surface soil and the P added to soils in the watershed. The total P load to the Great Lakes from the 300 subbasins of the agricultural region of the basin was estimated at 3000 tons per year, of which 2100 tons was attributed to cropland runoff, 600 tons to livestock operations, and 150 tons each to streambank erosion and unimproved agricultural land. Half of the total P load entered Lake Erie, the remainder being divided between Lake Huron and Lake Ontario. (Cassar-FRC)
W83-03841

5C. Effects Of Pollution

CONCENTRATION OF HEAVY METALS IN FISHES FROM THE RIVER DANUBE (SCHWERMETALLGEHALT VON FISCHEN AUS DER DONAU),
Bayerisches Landesamt fuer Wasserwirtschaft, Munich (Germany, F.R.).
B. Wachs.
Zeitschrift fuer Wasser und Abwasser Forschung, Vol 15, No 2, p 43-49, 1982. 5 Fig, 3 Tab, 36 Ref.

Descriptors: *Heavy metals, *Fish, Rivers, *Public health, *Water pollution effects, Aquatic animals, Chubs, Pike, Cadmium, Zinc, Copper, Mercury, Muscle, Liver, Kidneys, Federal Republic of Germany, Danube River.

In 1977 through 1980, the heavy metal content of fish from the Bavarian Danube area was determined. More than one hundred fish were netted in the area between km 2250 and km 2420 and analyzed. Species included chub (Leuciscus cephalus), Vimba bream (Vimba vimba), bream (Abramis brama) and pike (Esox lucius). Concentrations of the heavy metals Cd, Cr, Cu, Fe, Hg, Ni, Pb, and Zn were determined in muscle, liver, and kidney tissues. In fish muscle, the concentrations of heavy metals were in the following sequence (wet weight): Zn > Cu > Hg > Cd. The highest concentration of Cd and Zn in organs was found in the kidney. Cu was accumulated mostly in the liver, and Hg in the muscle. Only Cd levels were found to exceed the Federal health authority tolerance limit for human health. In 4% of the fish the muscle contained 0.06-0.10 mg/kd Cd. The concentration of heavy metals in fish is primarily related to the level of heavy metal in the water. Accumulation in fish is a result of the aqueous milieu and is not an effect of the food chain. For the heavy metals studied, there was no biomagnification within the aquatic fauna. (Author's abstract)
W83-03504

TOXICITY OF ORGANOLEAD COMPOUNDS: STUDY OF BACTERIAL INACTIVATION BY MEASUREMENT OF ATP (APPROCHE DE LA TOXICITE DES ORGANO PLOMBS ETUDE DE L'INACTIVATION BACTERIENNE PAR MESURES D'ATP),
Centre Oceanologique de Bretagne, Brest (France).
J. L. Charlou, G. Martin, M. Chaussepied, and A. Houeix.
Progressive in Water Technology, Vol 12, No 4, p 501-512, 1980. 9 Fig, 35 Ref.

Descriptors: *Lead, *Sewage bacteria, *Sediment-water interfaces, Wastewater, Activated sludge process, Water analysis, Chemical analysis, Interfaces, Bacteria, Activated sludge, *Toxicity, Denitrification, Adenosine triphosphate, France, Seawater, Microbiology, Organic compounds.

Organo-lead compounds were investigated as part of a larger geochemical project based on the study of elements or non-naturally occurring compounds which are accidentally discharged in to sea. Laboratory simulations of damaging conditions created by alkyl-lead compounds and their effects on marine organisms were investigated in order to evaluate the contamination effects on bacteria at the water-sediment interface. The study model used a denitrifying activated sludge because of the insolubility and the density of the organometallic compounds. Bacterial activity was calculated by measuring the speed of denitrification and by the presence of biomass. These are determined by measuring the amount of adenosine triphosphate (ATP). The lack of response to the toxic product is followed by the lowering of the denitrification speed and by the change in ATP. The following compounds were studied: Et(4)Pb, Et(3)PbCl, Et(2)PbCl(2), and PbCl(2). (Author's abstract)
W83-03510

SANITARY MONITORING OF SEAWATER IN BATHING AREAS OF FRANCE (SURVEILLANCE SANITAIRE DES EAUX DE BAIGNADE EN MER EN FRANCE),
Ministere de la Sante et de la Securite Sociale, Paris (France)
For primary bibliographic entry see Field 5G.
W83-03515

ACIDIFICATION EFFECTS ON MACROINVERTEBRATES AND FATHEAD MINNOWS (PIMEPHALES PROMELAS) IN OUTDOOR EXPERIMENTAL CHANNELS,
Saint Olaf Coll., Northfield, MN. Dept. of Biology.
J. A. Zischke, J. W. Arthur, K. J. Nordlie, R. O. Hermanutz, and D. A. Standen.
Water Research, Vol 17, No 1, p 47-63, January, 1983. 9 Fig, 5 Tab, 34 Ref.

Descriptors: *Invertebrates, *Fish, *Acidic water, *Water pollution effects, Aquatic life, Macroinvertebrates, Benthic fauna, Streams, Hydrogen ion concentration, *Fathead minnows, Species diversity, Metals, Aquatic insects, Aquatic life, Toxicity.

The effects of acidification of stream water on macroinvertebrate communities and fathead min-

nows (Pimephales promelas) were studied in 3 outdoor artificial channels at Monticello, Minnesota, during May-September 1979. Channel sections 122 m long and containing two mud buttom pools and two riffles each were used. The control channel had an ambient pH of 8; the others were acidified with sulfuric acid to pH 5 and 6. Macroinvertebrate densitites at the start of the study were 8414, 14789, and 20398 per sq m for channels of pH 8, 6, and 5, respectively. During June the control riffles had greater densities than the acidified riffles. By September the acidified riffles had 38-71% higher densities than the ambient riffles due to an increase in amphipod numbers. The numbers of insect taxa emerging from the control, pH 6 and pH 5 channels were 30, 28, and 18, respectively. Damselflies, isopods, and leeches were most tolerant to acid; chironomids, some amphipods (Crangonyx), and flatworms had intermediate tolerance; and other amphipods (Hyalella azteca) and snails (Physa gyrina) were most sensitive. Fathead minnow spawning and embryo production were similar in control and pH 6 channels, but little spawning and no eyed-embryos were found in the pH 5 channel. Larval fish did not survive to the juvenile stage in the pH 6 channel. (Cassar-FRC)
W83-03532

ENVIRONMENTAL LIMITING FACTORS AFFECTING THE GROWTH AND SPREAD OF CHALCALBURNUS TARICHI (PALL. 1881) (PISCES: CYPRINIDAE) IN BURDUR LAKE (DIE UMWELTFAKTOREN, DIE DIE VERBREITUNG UND ENTWICKLUNG VON CHALCALBURNUS TARICHI (PALL. 1881) (PISCES: CYPRINIDAE) IN BURDUR-SEE BEGRENZEN),
Istanbul Univ. (Turkey). Fen Fakultesi.
F. Aksiray.
Water Research, Vol 16, No 7, p 1107-1112, July, 1982. 2 Fig, 5 Tab, 21 Ref.

Descriptors: *CLosed lakes, *Brackish lakes, *Fish establishment, *Water pollution effects, Fish populations, Water analysis, Oxygen, Hydrogen sulfide, Food-processing wastes, Industrial wastes, Chemical analysis, Plankton, Aquatic life, Bottom sediments, Bottom sampling, Biological samples, Lake fisheries, Burdur Lake, *Turkey.

Productivity losses in the introduced fish Chalcalburnus tarichi in Burdur Lake were investigated through hydrobiological studies. The closed brackish lake has an area of 190 sq km and a depth of 76 m. Since 1969, two research stations have collected water, plankton, and bottom samples. Water samples were collected using Nansen bottles at 10 m intervals from the surface to the bottom. Chemical analysis was performed, including determination of dissolved oxygen. Plankton was collected in 10 m intervals using a Closing net, and plankton per cu m was determined. Ekman's dredge was used to collect bottom sediment, and biological content was determined. Wastewaters containing organic matter flow into the lake from the Burdur Sugar Mill, milk and cheese factories, the Attar of Rose industries, and hemp (Cannabis sativa) industries. An anoxic water layer containing hydrogen sulfide is formed above these wastes. The anoxic water layer has been increasing in thickness by 2 to 2.5 m per year. This has an adverse effect on bottom feeding and plankton populations, and thus affects the Chalcalburnus tarichi population. The future of the lake and its environment is threatened. (Small-FRC)
W83-03543

INFLUENCE OF MICROPOLLUTANTS ON VEGETATION,
Water Research Centre, Stevenage (England).
R. D. Davis.
Water Science and Technology, Vol 14, No 12, p 31-44, 1982. 7 Fig, 1 Tab, 20 Ref.

Descriptors: *Vegetation, *Water pollution effects, *Micropollutants, Land application, Sludge disposal, Metals, Herbicides, Organic compounds, Phytotoxicity, Soil properties.

Potentially phytotoxic inorganic and organic micropollutants are listed, and some of their effects are described. The use of plant analysis for assessing phytotoxicity in terms of relative pollution hazard is discussed. The discharges of sludges and effluents are facets of the water cycle which result in exposure of plants to micropollutants. When sewage sludge is applied to agricultural land, determination of total concentrations of micropollutants in soils indicates only the extent of contamination. Its significance in terms of phytotoxicity and transfer to food chains depends on soil conditions and crop type. Biological toxicity tests can be used both to screen for phytotoxicity in sludges and effluents before their discharge and to trace sources of phytotoxic pollutants. Inorganic micropollutants with potentially phytotoxic properties which are most commonly encountered in the water cycle include certain heavy metals and their compounds. Organic micropollutants of greatest significance to plants include herbicides and their residues. The use of sewage sludge on agricultural land and the use of river water and effluents for crop irrigation are two instances in which exposure of plants to micropollutants will occur. (Baker-FRC)
W83-03552

NATURE AND ORIGIN OF MICROPOLLUTANTS,
Toronto Univ. (Ontario). Dept. of Chemical Engineering and Applied Chemistry.
For primary bibliographic entry see Field 5B.
W83-03555

TEACHER'S RESOURCE GUIDE ON ACIDIC PRECIPITATION WITH LABORATORY ACTIVITIES,
Maine Univ. at Orono. Coll. of Education.
For primary bibliographic entry see Field 2K.
W83-03565

FACTORS REGULATING NUISANCE BLUE-GREEN ALGAL BLOOM POTENTIALS IN THE LOWER NEUSE RIVER, N.C.,
North Carolina Univ. at Chapel Hill. Inst. of Marine Sciences.
Hans W. Paerl.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-227413, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Research Institute Report No 188, North Carolina State Univ., Raleigh, May 1983. 55 p, 17 Fig, 22 Ref. OWRT A-122-NC(1), 14-34-0001-1135.

Descriptors: *Eutrophication, *Nuisance Algae, *Nutrients, Limiting Nutrients, Nitrogen, Nitrate, Phosphorus, *Cyanophyta, Primary productivity, Algal growth, *North Carolina, Neuse River.

Bi-weekly examinations of physical, chemical, and biotic factors, involved in the establishment and proliferation of blue-green algal (Microcystis aeruginosa) blooms in the lower Neuse River indicated several causative agents. Included are: (1) excessive concentrations of both nitrogen and phosphorus throughout much of the year and (2) periods of low flow and decreased turbulence (vertical mixing), leading to thermal stratification of the water column. Periods of thermal stratification, even lasting only a day or two, are instrumental in promoting dominance by surface-dwelling Microcystis populations. A combination of these physical and chemical agents leads to maximal bloom development. It was determined that bloom regulation by temperature is secondary to regulation by other physical factors and nutrient sufficiency. Also, periodic salinity intrusions into the lower river are ineffective in arresting Microcystis bloom potentials, particularly in surface waters where bloom intensity is often most severe. Nutrient-dilution bioassays were used to determine which nutrients were closest to 'limiting' concentrations. Preliminary experiments indicate that nitrogen, largely as NO sub 3-, reductions (of at least 30%) are more effective than phosphorus reductions in arresting bloom potential. These findings dictate an immediate concern for stemming nitrogen loading. Parallel decreases in phosphorus loading would be also desirable in the long run. Nitrogen constraints without parallel phosphorus constraints may promote N sub 2-fixing nuisance blue-green algae, such as Anabaena, as opposed to the non-N sub 2-fixing Microcystis.
W83-03566

THE FATE, DISTRIBUTION AND LIMNOLOGICAL EFFECTS OF VOLCANIC TEPHRA IN THE ST. JOE AND COEUR D'ALENE RIVER DELTAS OF LAKE COEUR D'ALENE, IDAHO,
Idaho Univ., Moscow. Coll. of Forestry, Wildlife and Range Sciences.
For primary bibliographic entry see Field 5B.
W83-03597

A PRELIMINARY INVESTIGATION INTO THE USE OF CRAYFISH AS A SENSITIVE SPECIES TO POLLUTANTS IN THE CLARK FORK RIVER NEAR MISSOULA, MT,
Montana Univ., Missoula. Dept. of Botany.
For primary bibliographic entry see Field 5B.
W83-03617

NUTRIENT AND MULTI-SPECIES CRITERIA STANDARD FOR THE CHOWAN RIVER, NORTH CAROLINA,
North Carolina State Univ. at Raleigh. Dept. of Botany.
A. M. Witherspoon, and R. Pearce.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-236158, Price codes: A08 in paper copy, A01 in microfiche. Water Resources Research Institute Report No 187, North Carolina State Univ., Raleigh, December 1982. 168 p, 133 Fig, 24 Tab, 56 Ref. OWRT B-127-NC(6), 14-34-0001-0274.

Descriptors: *Eutrophication, *Nutrients, *Nutrient requirements, *Phytoplankton, *Algae, Biomass, Chlorophyll A, Cyanophyta, Microcystis, Anabaena, Aphanizomenon, Nitrogen, Ammonia, Nitrate, Phosphorus, Phosphate, Water temperature, *North Carolina, Chowan River.

An investigation of changes in nutrient concentrations, phytoplankton biomass, and environmental parameters in the Chowan River Complex (CRC) was conducted from October 1978 through December 1981. The response of phytoplankton to a given concentration of a given nutrient was determined using a growth response ratio (RR) for each nutrient relative to chlorophyll-a and algal wet weight biomass. Species of the three genera that periodically bloom in the river were isolated and a minimum nutrient requirement for each was determined. The results suggest that the CRC is in excess of necessary nutrients for moderate algal growth. In the order of descending nitrogen requirements for initiating cyanophyceae algal growth, the species were: Microcystis, Anabaena and Aphanizomenon. Initiating P0 sub 4 concentrations depended upon the physiological state of the species and the light and temperature regime to which they were exposed. Using the extent to which RR sub N03, RR sub NH4 and RR sub OP exceed the efficiency level of 1.0 per chlorophyll-a, reductions of 48% NO sub 3 23% NH sub 4 and 27% OP would be required for algal biomass (as chloro-a) to be reduced to 40 mug/l; the margin determined as the maximum desirable, concentration for the CRC. Because blue-green algae are 'luxury consumers' of PO sub 4, both PO sub 4 nitrogen should be reduced simultaneously. These results are discussed as they might relate to management of the CRC.
W83-03623

RESERVOIR EUTROPHICATION AND MANAGEMENT,
Lycott Environmental Research, Inc., Southbridge, MA.
For primary bibliographic entry see Field 5G.
W83-03629

IMPACT OF SNOWMELT-RUNOFF FROM AGRICULTURAL WATERSHEDS ON DISSOLVED OXYGEN,

Wisconsin Dept. of Natural Resources, Rhinelander.
For primary bibliographic entry see Field 5B.
W83-03636

ECONOMIC RESEARCH NEEDS RELEVANT TO IMPROVED DRINKING WATER QUALITY,
Resources for the Future, Inc., Washington, DC.
For primary bibliographic entry see Field 6B.
W83-03637

FATE OF HERBICIDES IN GROUNDWATER AND SURFACE RUNOFF AND THEIR BIOTIC EFFECTS ON PRAIRIE POTHOLES,
North Dakota Univ., Grand Forks. Dept. of Biology.
For primary bibliographic entry see Field 5B.
W83-03682

EFFECTS ON CHANNEL CATFISH OF HIGH NITRITE CONCENTRATIONS THAT OCCUR IN FISH PONDS,
Auburn Univ., AL. Dept. of Fisheries and Allied Aquacultures.
J. M. Grizzle.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-246470, Price codes: A02 in paper copy, A01 in microfiche. Water Resources Research Institute Completion Report, Auburn, Ala., June 1983. 6 p, 5 Ref. OWRT A-079-ALA(1), 14-34-0001-2101.

Descriptors: *Fish diseases, *Nitrite, *Catfish, Aquaculture, Water pollution effects, Toxcity, Animal pathology, Pathogenic bacteria, Aeromonas, Myxobacteria.

The concentraton of nitrite lethal to one-half (LC50) of the channel catfish Ictalurus punctatus in a 96-hour, flow-through toxicity test was 13.7 mg/liter. A high percentage of methemoglobin caused the blood to be brown and was the most consistent effect of nitrite exposure. Chronic exposure to nitrite caused degeneration of erythrocytes and lactic acidosis. Histological lesions were not found in nitrite-exposed fish, but vacuolation of hepatocytes due to glycogen decreased in fish with methemoglobinemia. The percentage of methemoglobin decreased during chronic exposure, and this apparent acclimation may explain the ability of nitrite-exposed fish to grow at the same rate as controls during a 4-month experiment. Exposure to 5 mg/liter nitrite predisposed channel catfish to infection by Aeromonas hydrophila and Flexibacter columanris, common bacterial pathogens of fish. Fish exposed to 4.5 mg/liter nitritehad lower antibody titers 14 days after vaccination than vaccinated controls. This inhibition of antibody production may be related to the increased susceptibility of nitrite-exposed channel catfish to bacterial infection. This study demonstrated that nitrite concentrations as low as 4-5 mg/liter have prolonged effects on channel catfish, including increased suspectibility to bacterial diseases.
W83-03698

EFFECTS OF ACID DEPOSITION (RAIN) ON A PIEDMONT AQUATIC ECOSYSTEM: ACID INPUTS, NEUTRALIZATION, AND PH CHANGES,
Clemson Univ., SC. Dept. of Environmental Systems Engineering.
A. W. Elzerman, and R. W. Talbot.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-246496, Price codes: A05 in paper copy. A01 in microfiche. Water Resources Research Institute Publication No 108, Clemson Univ., SC., May 1983. 79 p, 10 Fig, 17 Tab, 35 Ref. OWRT B-141-SC(1), 14-34-001-1262.

Descriptors: *Acid rain, *Air pollution effects, *Chemistry of precipitation, Aquatic environment, Areal precipitation, Cation exchange, Earth-water interfaces, Enviromental effects, Geochemistry, Hydrogen ion concentration, Ion exchange, Leaching, Pollutants, Rainfall impact, Stream pollution, *South Carolina, Lake Issaqueena.

The overall objective of the investigation was to make an initial assessment of the significance of acid deposition to lakes in the South Carolina Piedmont and nearby southern Appalachian Mountains and conduct an intensive investigation of a selected watershed (Lake Issaquenna, Pickens County, South Carolina). Amounts and types of acid inputs, storm event changes in streamwater chemistry, the influence of acid deposition on watershed mass balances, and neutralization mechanisms and capacities were considered. Significant dry and wet fall out acid inputs were determined. Neutralization of incoming acid was sufficient to maintain relatively constant pH values in streams and lakes, but increased weathering and fluxes of calcium, magnesium, sodium, aluminum and trace metals out of the watershed were observed and low alkalinities indicated potential sensitivity to acid inputs. Ion exchange on clays appeared significant to neutralization, with evidence for both kinetic and equilibrium control of leaching. Sulfate adsorption was probably significant to cation mobility. Acid weathering of clays resulted in aluminum concentration increases in streams during storm events. Potential long-term adverse impacts of acid deposition were identified.
W83-03700

TOXIC EFFECTS OF NITRITE ON CHANNEL CATFISH,
Auburn Univ., AL. Dept. of Fisheries and Allied Aquacultures.
W. R. Garrett, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-246934, Price codes: A04 in paper copy, A01 in microfiche. M. S. Thesis, Auburn University, AL, August 1983. 61 p, 10 Fig, 2 Tab, 93 Ref, 4 Append. OWRT A-079-ALA, 14-34-0001-2101.

Descriptors: Catfish, *Catfish ponds, *Nitrites, *Toxicity, *Water pollution effects, Fish, Catfish, Farming, Fish toxins, Lethal limit, *Channel catfish.

Channel catfish, Ictalurus punctatus, were exposed to acute and subacute concentrations of nitrite in flow-through toxicity tests. The 96-hour medium lethal concentration (LC50) and asymptotic LC50 for nitrite were 13.7 mg/l. Hematological and histological effects during subacute (10-day and 21-day) exposures were assessed. Methemoglobinemia was the most noticeable effect of subacute nitrite poisoning with methemoglobin levels increasing during an eight-hour exposure from 2.4 to 32.5% for 1 mg/l nitrite and from 2.8 to 68.4% for 5 mg/l nitrite. In fish exposed to 5 mg/l nitrite, hematocrit decreased after 14 days but then increased to control levels at 21 days. Changes in hematocrit may be related to degeneration of erythrocytes and a subsequent production of reticulocytes. No nitrite-related changes were observed in plasma chloride and plasma protein levels. Plasma glucose increased after 8 hours in fish exposed to 5 mg/l nitrite, then decreased after 72 hours. Plasma lactic acid increased significantly over controls after 72-96 hours. Plasma corticosteroid concentrations in fish exposed to 5 mg/l (10-day exposure) were significantly greater than in 1 mg/l exposed and control fish after 72 and 96 hours. Histological lesions were not observed after subacute exposure to nitrite. Glycogen-related vacuolation of hepatocytes decreased and was inversely correlated with methemoglobin concentrations in fish exposed to nitrite. Methemoglobinemia was the most consistent effect of nitrite exposure and would be more useful in determining that channel catfish had been exposed to nitrite than any of the other hematological or histological changes found in this study.
W83-03709

KINETICS OF PHOSPHORUS UPTAKE IN THE CHOWAN RIVER, NORTH CAROLINA,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
For primary bibliographic entry see Field 5B.
W83-03711

THE EFFECTS OF BOTTOM WATER ANOXIA ON BENTHNIC NUTRIENT FLUX RATES IN THE PAMLICO RIVER,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
S. E. Cabaniss.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-246975, Price codes: A04 in paper copy, A01 in microfiche. M. S. Thesis, 1982. 62 p, 9 Fig, 4 Tab, 48 Ref, 1 Append. OWRT B-144-NC(2), 14-34-0001-1257.

Descriptors: *Bottom water, *Oxygen depletion, *Cycling nutrients, *Estuaies, Sediment-water interfaces, Interstial water, Nutrients, Phosphate, Ammonium, Rivers, Geochemistry, Benthic environment, *North Carolina, Pamlico River.

The benthic fluxes of phosphate and ammonium were determined in the Pamlico River, North Carolina, during the summer of 1981. Diffusive flux calculations from pore water concentration profiles and direct measurement of flux rates by in situ chamber incubations were compared and used to quantify the effect of bottom water anoxia on nutrient fluxes. Phosphate fluxes did not correlate with the phosphate concentration gradient at the sediment water interface. Ammonium fluxes correlated with the ammonium gradient and indicated the presence of a significant ammonium sink in the upper sediment. The average ammonium flux was over twofold higher during bottom water anoxia than before or after. Phosphate fluxes from sediment were very low before anoxia, exceptionally high at the onset of anoxia and moderately high during anoxia. Reversal of the flux direction was observed when oxygen returned to the bottom water as phosphate diffused into the sediment.
W83-03713

LEVELS OF NONPOLAR ORGANIC COMPOUNDS IN THE COLUMBIA GENERATING STATION COOLING POND,
Wisconsin Univ.-Madison. Dept. of Water Chemistry.
A. W. Andren, and R. Erickson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-249581, Price codes: A02 in paper copy, A01 in microfiche. Water Resources Center Publication No WIS WRC 83-08, 1983. 13 p, 1 Fig, 4 Tab, 5 Ref. OWRT A-090-WIS(1), 14-34-0001-0153.

Descriptors: *Cooling ponds, *Hydrocarbons, *Organic compounds, *Powerplants, Chlorinated hydrocarbons, Coal, Electric powerplants, Fish, Sediments, *Wisconsin, Portage.

In 1970, plans to build a coal-fired generating station near Portage, Wisconsin and an interest by involved utilities in carrying out a preconstruction analysis of potential environmental changes created a unique opportunity for broadly based research on the impacts of coal-fired steam plants. Of particular concern to aquatic scientists are the potential problems associated with the 192-ha manmade cooling pond. The research presented in this report describes a survey of the types and levels of nonpolar xenobiotic organic compounds in sediments and fish from the cooling pond. Sediment and fish samples were analyzed for PCBs, sum DDT, and hexachlorobenzene using techniques developed at the Water Chemistry Laboratory, University of Wisconsin-Madison. It was hypothesized that polyaromatic hydrocarbons and chlorinated hydrocarbons would accumulate; however, results indicate that the microcontaminants do not concentrate in the cooling pond. Reasons for why there is no microcontaminant problem are presented.
W83-03717

EFFECT OF SIMULATED ACID PRECIPITATION ON ALGAL FIXATION OF NITROGEN AND CARBON DIOXIDE IN FOREST SOILS,
Cornell Univ., Ithaca, NY. Lab. of Soil Microbiology.
F-H. Chang, and M. Alexander.
Environmental Science and Technology, Vol 17, No 1, p 11-13, January, 1983. 2 Tab, 13 Ref.

Descriptors: *Acid rain, *Algae, *Nitrogen fixation, Water pollution effects, Forest soils, Carbon

dioxide, Toxicity, *New York, Watersheds, Adirondacks region.

Indigenous algae growing in soil samples from the Panther, Woods, and Sagamore Lake watersheds of the Adirondacks regions of New York were exposed to acid precipitation of pH 3.5 or 5.6 at rates of 50, 100, 200, and 300 cm. Rates of nitrogen fixation as measured by acetylene reduction were significantly less for soils watered with pH 3.5 water compared with the pH 5.6 water for all rainfall intensities, for light and dark, and for all soils. As rain volume increased, acetylene reduction decreased for the 3.5 pH water and increased for the 5.6 pH water. Carbon dioxide fixation rate was significantly less for all soils exposed to the more acid rain, and the extent of inhibition became more pronounced with increasing volumes of rain applied. (Cassar-FRC)
W83-03797

5D. Waste Treatment Processes

THE BIODEGRADATION OF BIS (TRIBUTYLTIN) OXIDE (TBTO) BY BILOGICAL SEWAGE TREATMENT (DER BIOLOGISCHE ABBAU VON TRIBUTYLZINNOXID (TBTO) IN EINER BELEBTSCHLAMMANLAGE),
T. Stein, and K. Kuster.
Zeitschrift fuer Wasser-und Abwasser Forschung, Vol 15, No 4, p 178-180, August, 1982. 1 Tab, 7 Ref.

Descriptors: *Biological wastewater treatment, *Organotin compounds, Bis(tributyltin) oxide, Bacteria, Microorganisms, *Wastewater treatment, Municipal wastewater, Industrial wastes, Water pollution control.

The biodegradation of bis(tributyltin) oxide was studied in relation to continuing emphasis on the influence of tributyltin compounds on microorganisms of the biological sewage treatment plant. It was demonstrated that at a TBTO concentration of 2 mg/liter the biodegradation to inorganic tin compounds is more than 87%. An essential condition to reach this level of degradation is a long adaptation phase of the biological system to the organotin compounds. (Baker-FRC)
W83-03506

POLLUTION OF THE MEDITERRANEAN COASTAL AREA (LA POLLUTION DU LITTORAL DE LA MEDITERRANEE),
R. Ringuelet.
Progress in Water Technology, Vol 12, No 4, p 695-722, 1980. 6 Fig, 6 Tab.

Descriptors: *Stabilization ponds, *Stabilization lagoons, *Coastal waters, *Seasonal variation, *Wastewater treatment, Design criteria, Coastal zone management, Water pollution control, Brochemical oxygen demand, Municipal wastes, Bacteria, *Mediterranean Sea, *France.

The natural stabilization pond or lagoon is well suited as a treatment method for the coastal areas of the Mediterranean which experience seasonal demands. In Languedoc, this type of treatment has been studied for 15 years and quantified over the past 5 years. Design parameters are presented. The water depth should be 1.2 m in the first lagoon and 1 m in subsequent lagoons. The normal maximum loading is 75 kg BOD/hectare/day, with a short midsummer peak period of 100-120 kg BOD/day. The detention period is 30 to 50 days. One hectare is necessary for the removal of bacteria from sewage for a population of 2000 persons in winter and 3000 persons in summer. (Small-FRC)
W83-03509

PREFERRED SOLUTIONS AND DEVELOPMENT TRENDS FOR WASTEWATER CONVEYANCE IN DRAINAGE NETWORKS (VORZUGSLOSUNGEN UND ENTWICKLUNGSTENDENZEN DER ABWASSERFORDERUNG IN ENTWASSERUNGSNETZEN),
VEB Projektierung Wasserwirtschaft, Halle (German D.R.).
P. Richardt.
Wasserwirtschaft-Wassertechnik, Vol 32, No 7, p 227-229, July, 1982. 5 Fig, 3 Tab, 1 Ref. (No English Summary).

Descriptors: Hydraulic engineering, *Wastewater collection, *Drainage systems, *Detritus, *Pumps, Solid wastes, *German Democratic Republic, Construction costs, Design criteria, Hydraulic design, Hydraulic equipment, Sieves, Water conveyance, *Conveyance structures.

The current preferred practice for the conveyance of wastewater in the German Democratic Republic is to transport solid debris together with the wastewater into the pressure pipe network and to remove debris from the wastewater at the treatment plant. However, pumping gear now in use is equipped to fulfill this requirement only up to a maximal volume flow of 2,000 cu m/hr; above this level, debris must be removed by grids at the pumping station. Preferred methods of conveying debris with wastewater include the sieve reservoir pump, pumping stations with wastewater immersion pumps, and prechamber pumps. With the sieve reservoir pump, debris is held back by a sieve in a steel tank that is divided by the sieve into a preliminary purification area and a wastewater collection area. Wastewater is then transported from the later in the opposite direction from the inflow back to the sieve, and from there, both wastewater and debris are fed into the pressure pipe. Wastewater immersion pumps reduce construction costs, space and time. The prechamber pump consists of an underground section divided into prechamber, wastewater collection area, and pump room and an above-ground section that has now been reduced by about 60% compared to the area previously required. Prechamber and collection area are divided by a grid that is inclined against the inflow direction so that debris is retained in the prechamber. The present trend of development is to reduce construction and thereby construction time by measures including compact installation of advanced technological equipment. (Gish-FRC)
W83-03517

STUDIES ON THE SOIL APPLICATION TREATMENT OF COKING PLANT WASTEWATER (UNTERSUCHUNGEN ZUR BODENBEHANDLUNG VON KOKEREIABWASSER),
Institut fuer Wasserwirtschaft, Berlin (Germany, F.R.).
F. Schulz, D. Steyer, and W. Kruger.
Wasserwirtschaft-Wassertechnik, Vol 32, No 7, p 233-235, July, 1982. 1 Fig, 5 Tab, 9 Ref. (No English Summary).

Descriptors: *Advanced wastewater treatment, *Soil treatment, *Mine wastes, *Wastewater irrigation, *Lysimeters, Wastewater disposal, Wastewater treatment, Percolation, Groundwater, Land disposal, Nitrogen, Potassium, Organic acids, Phenols, Organic acids, Phenols, Organic compounds, Water quality.

Advanced treatment of wastewater from the brown-coal thermal processing industry by passing the water through soil allows multiple use of the water with nitrogen reclamation. Lysimete studies were conducted on enriched soil formed from mining wastes and treated in this way. In similar untreated soil, 11-23% of natural precipation (mean 15%) percolated through the soil over a three-year period, while for soil sprinkled with wastewater, 38-61% (mean 46%) of natural precipitation plus added wastewater percolated. Mining-waste soil is characterized by high volatile organic acids and other chemically oxidizable organic matter (COOM) and by the presence of inorganic acids and potassium showed levels many times higher than those in untreated soil, whereas levels for COOM and inorganic nitrogen were only 62 and 85% higher, respectively, in treated soil. The lysimeter measurements showed that the purification efficacy of this wastewater treatment method was 100% for phenol compounds, a mean of 93% for COOM, 74% for volatile organic acids, and 89% for inorganic nitrogen. Groundwater quality > 20 m below the mining waste soil was also studied: phenol compounds were not found; volatile organic acids were found in high and variable amounts, but were not related to wastewater application; COOM levels were also variable, and although they were higher within the treated area, were not directly attributable to wastewater application; potassium and nitrogen levels were unrelated to wastewater application. This three-year treatment program allowed 3.3 million cu m wastewater containing 380 ton phenols, 2,770 ton volatile organic acids, and 595 ton NH4-N to be held back from the receiving stream. (Gish-FRC)
W83-03519

ECONOMICAL WATER USE AND RECOVERY OF VALUABLE MATERIALS BY MEANS OF ION EXCHANGERS IN THE SURFACE FINISHING INDUSTRY (WIRTSCHAFTLICHE WASSERVERWENDUNG UND WERTSTOFFRUCKGEWINNUNG DURCH IONENAUSTAUSCHER IN DER OBERFLACHENVEREDELNDEN INDUSTRIE),
For primary bibliographic entry see Field 3E.
W83-03521

HYDROCARBON REMOVAL IN A THREE-PHASE FLUIDIZED EXPERIMENTAL BED AND MODELLING OF THE PROCESS (EPURATION HYDROCARBONNE EN COUCHE FLUIDISEE TRIPHASIQUE ETUDE EXPERIMENTALE ET MODELISATION),
Montpellier-2 Univ. (France). Lab. de Genie Chimique, Traitment et Epuration des Eaux.
A. Grasmick, B. Chatib, S. Elmaleh, and R. Ben Aim.
Water Research, Vol 15, No 6, p 719-727, June, 1981. 8 Fig, 8 Tab, 11 Ref.

Descriptors: *Fluidized beds, *Fluidized bed process, *Model studies, *Mathematical models, *Wastewater treatment, Hydrocarbons, Turbulent flow, Aeration, Biological wastewater treatment, Biological oxygen demand, Mass transfer, France.

A 9.4 cm three-phase fluidized bed reactor was evaluated, and a model based on previous work on fixed-bed reactors is proposed. In the new reactor, turbulence induced by air injection should remove excess biomass and avoid bed clogging. With step injections of synthetic sewage for different values of working parameters, the reactor had an elimination efficiency of 10 kg BOD5/cu m/day without recycle. Limitations of the three-phase fluidized reactor were insufficient oxygen transfer to the liquid phase due to rapid bubble coalescence; and inefficient sloughing, which allows the reactor to be segregated depending on biofilm thickness. In the model, interphase mass transfer and zero order reaction within the biofilm are taken into account, and it is assumed that the liquid phase is perfectly mixed. The model's two parameters are a combination of the numbers of transfer units within the biofilm and through the boundary layer and of the number of reaction units in the biofilm. Oxygen, organic carbon, or any other nutrient may be the limiting substrate. The model predicts experimental efficiencies with an accuracy of 15%. (Small-FRC)
W83-03531

THE ADSORPTION OF BOVINE SERUM ALBUMIN BY ACTIVATED SLUDGE,
University Coll., Dublin (Ireland).Dept. of Industrial Microbiology.
M. B. Crombie-Quilty, and A. J. McLoughlin.
Water Research, Vol 17, No 1, p 39-45, January, 1983. 4 Fig, 2 Tab, 19 Ref.

Descriptors: *Activated sludge process, *Adsorption, *Colloids, *Wastewater treatment, *Albumin, Kinetics, Biomass, Activated sludge adsorption equation.

Bovine serum albumin (BSA) was rapidly removed by BSA-acclimated activated sludge via adsorption. The extent of adsorption (2-42%) varied with the substrate: biomass ratio. The concentration of BSA adsorbed was influenced by both the concentration of BSA and the concentration of activated sludge. The experimental data did not conform to Langmuir or Freundlich equations, but fit the newly developed activated sludge adsorption equa-

tion proposed by Banerji et al. (1968). The concentration of BSA adsorbed per unit weight activated sludge and the concentration of BSA in equilibrium per unit weight activated sludge were expressed as functions of the concentration of BSA added to the system per unit weight adsorbent. This related adsorption to the substrate: biomass ratio. (Cassar-FRC)
W83-03533

A DYNAMIC MODEL OF THE HIGH-RATE ALGAL-BACTERIAL WASTEWATER TREATMENT POND,
Cape Town Univ. (South Africa). Dept. of Chemical Engineering.
H. O. Buhr, and S. B. Miller.
Water Research, Vol 17, No 1, p 29-37, January, 1983. 6 Fig, 2 Tab, 30 Ref.

Descriptors: *Algae, *Bacteria, *Ponds, *Wastewater treatment, Model studies, Oxidation ponds, Algal growth, Diurnal variation.

The symbiotic growth of algae and bacteria in a high-rate wastewater treatment pond was described by a mathematical model, which included components for algal growth, light limitation, aerobic bacterial growth, solution equilibria, and material balances. Simulated results agreed with experimental results reported by Dors in 1974. Operating parameters (pH, dissolved oxygen, and substrate concentration) changed in a diurnal pattern and along the length of the race-track shaped channel. An equation calculated an appropriate circulation rate for maintaining turbulent flow and adequate mixing. Temperature was important in determining the feed residence time. A curve presented the algal yield vs. hydraulic residence time for ponds of 300, 400, and 500 mm depth and temperatures of 10, 20, and 30C. (Cassar-FRC)
W83-03534

TESTS ON AERATORS: CONCLUSIONS DRAWN FROM 500 CLEAN WATER TESTS CONDUCTED IN 200 DIFFERENT SEWAGE TREATMENT PLANTS - I TEST PROCEDURE (ESSAIS D'AERATEURS ENSEIGNEMENTS TIRES DE 500 ESSAIS EN EU CLAIR EFFECTUES DANS 200 STATIONS D'EPURATION DIFFERENTES - I METHODOLOGIE),
Centre National de Machinisme Agricole du Genie Rural, des Eaux et des Forets, Paris (France).
A. Heduit, and Y. Racault.
Water Research, Vol 17, No 1, p 97-103, January, 1983. 2 Fig, 7 Tab, 16 Ref. English abstract.

Descriptors: *Wastewater treatment facilities, *Testing procedures, *Aerators, *Wasterwater treatment, Oxidation, Aeration, Dissolved oxygen, Sampling, Sulfite.

Aeration represents the main part of energy consumption in the activated sludge process, and the evaluation of aeration systems' efficiency is becoming more important as energy costs increase. All of the present tests were conducted using tap water under non-steady-state conditions. The initial dissolved oxygen level is brought down to zero by adding cobalt chloride as catalyst and sodium sulfite. When all of the sodium sulfite has been consumed, the increase in water dissolved oxygen content is monitored vs time at various locations in the tank by means of membrane probes. In tests on water quality parameters it appeared that only the presence of surfactants, flocculated suspended solids, or high salinity are liable to have any appreciable effect on oxygen transfer. The unflocculated SS, pH and alkalinity have no effect on oxygenation results in the common range of values occurring in the tests. Recommendations are given for the application of specific tests to sewage treatment plants. (Baker-FRC)
W83-03535

DISPERSION IN THE INCLINED PLANE MODEL OF TRICKLING FILTERS,
Technical Univ. of Istanbul (Turkey). Dept. of Environmental Engineering.
Y. Muslu.
Water Research, Vol 17, No. 1, p 105-115, January, 1983. 7 Fig, 7 Tab, 13 Ref.

Descriptors: *Trickling filters, *Dispersion, *Mathematical equations, Hydraulics, Filtration, *Wastewater treatment, Flow, Model studies.

An attempt is made to establish a relationship between the removal efficiency and the hydraulic regimes of biological filters. For this purpose an equation was first derived to determine the dispersion number. Using this equation, effluent concentration was calculated by means of dispersed plug flow models in the range of channelized flow and for large hydraulic loadings. Around the minimum wetting rate, the removal efficiencies are computed with equations of complete mixing. The application of this theory to the experimental results reported in the literature has been shown, and the ranges of validity of dispersed plug flows and mix flows are determined. It is also demonstrated that the predicted concentrations are in good agreement with the measured values. At large flow rates the dispersed plug flow model gave good results. Between the mixed and dispersed flow zones defined by the limits given there are transition regions corresponding to other mixing conditions. Increasing concentrations tend to decrease removal somewhat, particularly in the range of low applied loading. However, it can be concluded that concentration has the least effect on removal efficiency when compared with other factors. For BOD5 concentrations less than 200 mg/liter the equation expressing the first order kinetic relationship is a reasonable approximation for low rate trickling filters, as the dispersion numbers are small. (Baker-FRC)
W83-03537

THE BIODEGRADATION OF N-METHYL-2-PYRROLIDONE IN WATER BY SEWAGE BACTERIA,
Department of Scientific Services, Singapore.
S. T. Chow, and T. L. Ng.
Water Research, Vol 17, No 1, p 117-118, January, 1983. 6 Ref.

Descriptors: *Wastewater treatment, *Bacteria, *Biodegradation, N-Methyl-2-pyrrolidone, Sewage bacteria, Oxygen demand, Metabolites.

The biodegradability of N-methyl-2-pyrrolidone was studied using a static die-away system and a semi-continuous activated sludge system. The NMP concentrations of the filtered supernatant culture mixture were determined by gas-liquid chromatography using menthol as internal standard. On the PEG 20M column, menthol and NMP haveretention times of 9.5 and 11.5 min, respectively. No peak was noted in a culture solution which has not been dosed with NMP but which contained all the other ingredients required for the biodegradation test. Results of the die-away test showed that NMP is readily biodegradable in a static system. A value of 95% biodegradability was obtained after a 2 week period of incubation. With the semi-continuous activated sludge test, after 5 days of incremental acclimatin to 100 ppm of NMP, a 7-day average biodegradability of 95% was obtained. The tests indicated that NMP did not break down to carbon dioxide and water under these conditions. The metabolite has an appreciable oxygen demand, which is about half that of NMP. To study the metabolite further the culture mixture from the static die-away test was extracted with chloroform and analyzed by infrared spectroscopy. Results indicated that in the biodegradation of NMP, the C-N bond between the nitrogen atom and the carbonyl group was cleaved. (Baker-FRC)
W83-03538

INNOVATIVE TECHNOLOGY RECYCLES WASTE.
Hirsch and Co., San Diego, CA.
World Dredging and Marine Construction, Vol 18, No 12, p 9-13, December, 1982. 5 Fig.

Descriptors: *Wastewater treatment, *Water recycling, *Water reuse, *Aquaculture, Hyacinths, Plants, San Diego, *California, Bacteria, Snails, Catfish, Crayfish, Drinking water, Water supply development.

The San Diego Water Utilities Aquaculture Project takes 25,000 gallons of raw sewage a day, filters it, lets water hyacinths absorb the unwanted nitrate-phosphate nutrients in sewage, filters it again and adds reverse osmosis, a process that draws remaining impurities out of the solution, with the end product being clear and potable water. In a man-made swamp biosphere the hyacinths work with crayfish, catfish and snails living on the bottom of a four feet deep tank to take 99% of the bacteria out of the water. Reverse osmosis removes nearly all the remaining bacteria and salts, and a final cleanup is made with carbon absorption and a disinfectant, such as chlorine or ozone. The recycled water is used to grow replacement sod on the home turf of San Diego's major sports stadium. The water hyacinths grown on the wastewater nutrients are converted to fertilizer, methane gas, and animal fodder. The goals of the program were to prove that there is a better way to treat sewage, that pure drinking quality water can be produced, and that animal fodder and energy are valuable spin-off products. (Baker-FRC)
W83-03545

MICROPOLLUTANTS PRODUCED BY DISINFECTION OF WASTEWATER EFFLUENTS,
Oak Ridge National Lab., TN.
R. L. Jolley, R. B. Cumming, N. E. Lee, J. E. Thompson, and L. R. Lewis.
Water Science and Technology, Vol 14, No 12, p 45-49, 1982. 1 Fig, 2 Tab, 17 Ref.

Descriptors: *Wastewater treatment, *Micropollutants, Water pollution sources, Mutagens, Organic compounds, Ozonation, Chlorination, *Disinfection, Chlorine, Ozone.

The effects of disinfection by chlorine, ozone, and ultraviolet light irradiation were examined on nonvolatile organic constituents relative to chemical effects and the formation of micropollutants. Disinfection with chlorine or ozone both destroys and produces nonvolatile organic constituents, including mutagenic constituents. The chemical effects of disinfection by UV irradiation were relatively slight, although the mutagenic constituents in one effluent were eliminated by this treatment. Nine wastewater treatment plants were selected for study. Grab sample collection was carried out on undisinfected and disinfected effluents. Over 100 micropollutants were identified in the wastewater effluent concentrates which were prepared from the grab samples. Considerable variability was noted in the presence of mutagenic nonvolatile organic constituents in the undisinfected effluent concentrates, as well as much variability in the destruction of the mutagenic constituents and the formation of other mutagenic constituents as a result of disinfection. No micropollutants known to be mutagens were identified in the mutagenic HPLC fractions separated from the undisinfected, chlorinated, and ozonated effluent concentrates. The mutagenic activity of the nonvolatile organic constituents in one chlorinated effluent concentrate was not attributable to organic chloramines. Most of the mutagens detected in effluent concentrates are direct acting and do not require metabolic activation. (Baker-FRC)
W83-03546

ELIMINATION OF ORGANIC MICROPOLLUTANTS,
Swedish Water and Waste Water Works Association, Stockholm.
B. Hultman.
Water Science and Technology, Vol 14, No 12, 73-86, 1982. 9 Tab, 63 Ref.

Descriptors: *Wastewater treatment, *Organic compounds, *Nitrosamines, Activated carbon, Adsorption, Stripping, Ozone, Oxidation, Biological degradation, Solubility, Volatility.

The elimination of organic micropollutants from water and wastewater may be done by separation methods, which are useful to concentrate and relocate pollutants so that they can be more readily recovered or destroyed, or by destruction and detoxification methods, in which the pollutants are destroyed and detoxified by the use of oxidation or reduction. Both of these principal methods are

discussed, with particular emphasis on similarities between treatment techniques, prediction methods of removal efficiencies and treatment of priority pollutants. It was concluded that if separation methods are used, it is important to consider the handling of the phase in which the micropollutant has been concentrated. During certain treatment processes micropollutants are formed. Of special interest is the formation of chlorinated organic compounds and nitrosamines. The processes for eliminating organic micropollutants include stripping by air and steam, ozone oxidation, activated carbon adsorption and biological degradation. Oxidation agents may be used for total oxidation of the organic material or for rendering the organic material biodegradable. The fugacity, related such to properties as solubility, volatility, octanol-water partitioning coefficient, and others, may be used to predict the removal efficiency of organic micropollutants in such processes as stripping and carbon adsorption in biological sludges. The combined use of oxidizing agents and flocculants may be suitable for conditioning of sludges and may partly reduce the sludge levels of organic micropollutants. (Baker-FRC)
W83-03547

BATCH FLOTATION TESTS: HOW USEFUL ARE THEY.,
J. Bratby.
Journal of the Water Pollution Control Federation, Vol 55, No 1, p 110-113, January, 1983. 23 Ref.

Descriptors: *Testing procedures, *Flotation, *Separation techniques, Mechanical equipment, Suspended solids, Solids, Clarification, *Wastewater treatment.

The scope and validity of batch tests applied to flotation are considered. A testing program designed to gather information on the clarification aspect of flotation would determine the relationship between the limiting downflow rate and the air/solids ratio. Procedures for obtaining such information with continuous-type tests have been outlined. The procedure with batch tests is to introduce the air-contacted wastewater feed to a flotation column that is usually 250 to 500 mm high and to carry out what amounts to an inverted settling test. At an air/solids ratio of 0.01, batch predicted effective rise rates would be greater by a factor of about 2.5 times the actual value; at an air/solids ratio of 0.025, the predicted value would be greater by a factor of about 1.4 times the actual value. The poor correlation between batch and continuous results for flotation clarification makes design data based on batch test results highly suspect. At the outset, batch flotation tests are particularly inappropriate for predicting thickening performance. It is virtually impossible to duplicate in-plant conditions. It is essential to optimize thickening design on the basis of solids loading rate and height of float above the water level. The air/solids ratio will be assigned a value based on the downflow rate and the total depth of float solids, and the scraper will be designed on the basis of removing float solids concentration and solids loading rate. (Baker-FRC)
W83-03549

BIOLOGICAL TREATABILITY OF SPECIFIC ORGANIC COMPOUNDS FOUND IN CHEMICAL INDUSTRY WASTEWATERS,
Oklahoma State Univ., Stillwater. School of Civil Engineering.
E. L. Stover, and D. F. Kincannon.
Journal of the Water Pollution Control Federation, Vol 55, No 1, p 97-109, January, 1983. 6 Fig, 9 Tab, 9 Ref.

Descriptors: *Wastewater treatment, Fate of pollutants, Pollutant identification, Model studies, *Organic compounds, Chemical reactions, *Biodegradation.

Development of a data base on the treatability and fate of specific organic compounds during biological treatment was initiated. The possibility of future limitations on specific compounds requires the capability to predict treatability and the fate of the compounds in question during treatment. Studies were conducted on the impacts on biodegradation of phenomena such as stripping and adsorption depending on the physical and chemical characteristics of specific compounds. The impacts of stripping on biokinetic constants have been shown for a variety of compounds, and means for analysis of these impacts was proposed through modification of the existing predictive models. The study combined selected organic compounds with a base mix that was readily biodegradable. The compounds were added individually and in groups to simulate real wastewaters. The biological systems were operated at three different sludge ages for each wastewater and monitored to develop the data needed for determining the biological kinetic constants. Each individual system was analyzed in terms of BOD, COD, TOC and the specific organic pollutants added. The fate of each specific compound during treatment was also determined. (Baker-FRC)
W83-03550

ENTEROCOCCI AND OTHER MICROBIAL INDICATORS IN MUNICIPAL WASTEWATER EFFLUENTS,
Food and Drug Administration, Davisville, RI. Shellfish Sanitation Branch.
For primary bibliographic entry see Field 5A.
W83-03551

THE ELIMINATION OF MINERAL MICROPOLLUTANTS,
Compagnie Intercommunale Bruxelloise des Eaux (Belgium).
B. Regnier, C. Goblet, J. Genot, and W. J. Masschelein.
Water Science and Technology, Vol 14, No 12, p 87-105, 1982. 6 Fig, 17 Tab, 19 Ref.

Descriptors: *Minerals, *Wastewater treatment, *Water treatment, Drinking water, *Water treatment, Oxidation, Alkalinity, Precipitation, Acidity, Ion exchange, Resins, Carbon, Adsorption, Nickel, Iron, Manganese, Sludge, Chromium, Colbalt, Cadmium, Lead.

Mineral micropollutants in waste waters and drinking waters are essentially composed of heavy metal salts. Their elimination when present in trace quantities is reviewed. The techniques available necessitate preclarification in open basins and elimination by filtration, with efficiencies depending largely on preoxidation but particularly on coagulation-precipitation and related techniques. The predominant importance of contact between water and sludges in decanters/clarificators is vital. The oxidation state of metals plays an important role in techniques for their elimination by the usual methods such as coagulation-flocculation-decantation, as well as in coprecipitation phenomena of Fe and Mn, for example. The method of alkaline precipitation, in which the pH value needed is obtained by addition of lime, results in elimination rates over 80% and generally far over 90%. This method simultaneously uses direct precipitation and coprecipitation in a calcium carbonate/magnesium oxide matrix. Ion exchange gives highly variable elimination results according to the ion present and its concentration. In practice, strong cation exchange resins are generally applied. In treatment plants adsorption on carbon allows an overall yield of 50-100% removal of the metal concerned, provided that preoxidation and sufficient contact times are allowed. Of the remaining traces, 30-50% are removed by infiltration of purified waters underground, where a levelling of concentrations also occurs. (Baker-FRC)
W83-03556

MEASUREMENT AND VALIDITY OF OXYGEN UPTAKE AS AN ACTIVATED SLUDGE PROCESS CONTROL PARAMETER,
Pirnie (Malcolm), Inc., Newport News, VA.
G. L. Edwards, and J. H. Sherrard.
Journal of the Water Pollution Control Federation, Vol 54, No 12, p 1546-1552, December, 1982. 20 Fig, 15 Ref.

Descriptors: *Activated sludge process, *Oxygen uptake, Aeration basins, Biochemical oxygen demand, Chemical oxygen demand, *Wastewater treatment, Oxygen demand, Flow, Water Quality, Virginia, Blacksburg.

The question was considered of whether or not specific oxygen uptake rate is a meaningful control parameter for the activated sludge process. Five different 24 hr studies were conducted at the Blacksburg and Virginia Polytechnic Institute Treatment Plant to study the effects of variable influent organic and hydraulic loadings on the specific oxygen uptake rate in the aeration basins and the corresponding effects on effluent quality. Results from 3 of the test periods are discussed. Based on these studies the following conclusions are drawn: a change in specific oxygen uptake rate for a wastewater of highly variable influent flow and organic loadings does not necessarily produce a significant change in effluent quality as measured by BOD and COD. Specific oxygen uptake rate cannot be used as a control parameter for the activated sludge process when treating a highly variable influent quantity and quality flow. (Baker-FRC)
W83-03569

DETERMINATION OF BIOMASS MLVSS IN PACT SLUDGES,
Akron Univ., OH. Dept. of Civil Engineering.
W. B. Arbuckle, and A. A. Griggs.
Journal of the Water Pollution Control Federation, Vol 54, No 12, p 1553-1557, December, 1982. 2 Fig, 2 Tab, 5 Ref.

Descriptors: *Wastewater treatment, *Activated sludge process, *Activated carbon, Volatility, Suspended solids, Water quality, Carbon, Powdered activated carbon treatment.

The Powdered Activated Carbon Treatment (PACT) process is basically a conventional activated sludge plant to which powdered activated carbon is added. The carbon is slurried and fed with the waste stream, which then flows into an aeration basin. During aeration, wastes are simultaneously adsorbed onto the carbon and biologically degraded. The mixture then goes to a clarifier, where the carbon and biomass settle for recycling to the aerator. The resultant effluent is consistently of higher quality than would be obtained from activated sludge alone. The waste sludge produced may be handled by conventional means or may be regenerated to recover activated carbon for reuse in the process. The concentration of PAC in the mixed liquor is an important new parameter. Six combinations of PAC and biomass were evaluated at six temperatures to determine volatility. Volatility increased with increasing temperature for all sludges except for 100% PAC, which had a constant fraction volatilized at temperatures less than 400C. The average error for five different combinations was 4.4%, with most of the error due to one sludge which contained 16.7% PAC. Results appear least accurate when PAC is 10 to 20% of the total sludge. (Baker-FRC)
W83-03570

DISCUSSION OF: EFFECT OF A BACTERIAL CULTURE PRODUCT ON BIOLOGICAL KINETICS,
Flow Labs., Inc., Inglewood, CA. Envirnmental Cultures Div.
R. B. Grubbs, T. G. Zitrides, C. S. McDowell, J. N. Zikopoulos, and L. M. Johnson.
Journal of the Water Pollution Control Federation, Vol 54, No 12, p 1614-1616, December, 1982.

Descriptors: *Bacteria, *Cultures, *Kinetics, Wastewater treatment, *Biological treatment.

The above titled paper by S. R. Qasim and M. L. Stinehelfer, Journal of the Water Pollution Control Federation, Volume 54, page 255, 1982, was criticized for several of its conclusions, based on laboratory tests of a biological wastewater treatment system. The author of the first comment questions the old references used, the disregard of scale effects in extrapolating results from laboratory to field, the selection of the bacterial culture used, and the composition of the experimental

wastewater. Authors of the second comment point out deficiencies in the following: data collection, experimental simulation of dynamic factors affecting all full-scale wastewater treatment plants, discussion of important trends in experimental data, description of test conditions, and support for conclusions. The authors of the original paper reply that their paper's intent was to present a methodology for evaluating bacterial culture products. (Cassar-FRC)
W83-03571

USE OF HYDROCYCLONES TO TREAT SEAFOOD-PROCESSING WASTEWATERS,
Alaska Univ., Fairbanks. Dept. of Engineering.
R. A. Johnson, and K. L. Lindley.
Journal of the Water Pollution Control Federation, Vol 54, No 12, p 1607-1612, December, 1982. 4 Fig, 1 Tab, 20 Ref.

Descriptors: *Food-processing wastes, *Industrial wastewater, *Cyclones, *Wastewater treatment, Seafood-processing wastes, Shellfish, Fish, Suspended solids, *Hydrocyclones, Alaska, Canneries, Particulate matter, Economic feasibility.

Hydrocyclones were used to collect particulate matter from seafood processing wastewaters in both laboratory and pilot scale studies. Laboratory cyclones of 25 to 75 mm diameter produced removal efficiencies of 68-92% (concentration factors of 2-8) using plant effluents containing king crab shell, shrimp waste, and salmon waste. The pilot wastewater treatment plant contained two 75 mm cyclones and a 25 mm cyclone. Pilot plant efficiencies were 69-86% and concentration factors, 5-18, depending on the number of cyclones used in the run and the type of waste (Tanner crab, shrimp, or salmon). Total suspended (kg per 1000 kg raw product) in the pilot scale cyclone effluents averaged 2 for crab wastewater, 5.7 for salmon wastewater, and 3.7 for shrimp wastewater. The low capital and operating costs associated with cyclones are well within the range of economic feasibility. In addition, the recovery of fish and shellfish meal can offset some of the treatment costs. (Cassar-FRC)
W83-03572

DISCUSSION OF: AMMONIA NITROGEN REMOVAL IN FACULTATIVE WASTEWATER STABILIZATION PONDS AND NITROGEN DYNAMICS IN WASTE STABILIZATION PONDS,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
F. A. DiGiano, E. J. Middlebrooks, and R. A. Ferrara.
Journal of the Water Pollution Control Federation, Vol 54, No 12, p 1617-1618, December, 1982. 2 Fig, 1 Ref.

Descriptors: *Nitrogen removal, *Stabilization ponds, *Wastewater lagoons, *Wastewater treatment, Ammonia, Volatilization, Algae, Lagoons.

Two papers on the subject, mechanisms of nitrogen removal from wastewater stabilization ponds, used data collected from similar ponds but reached different conclusions. A. Pano and E. J. Middlebrooks (Journal of the Water Pollution Control Federation, Volume 54, page 344, 1982) attributed nitrogen removal to ammonia volatilization. R. A. Ferrara and C. B. Avci (same journal, Volume 54, page 361, 1982) stated that volatilization was not responsible for nitrogen removal because algal uptake removes ammonia-N. The writer of the criticism disagreed with some of the equations used by Pano and Middlebrooks, who in turn claimed that DiGiano's equations were incorrect. Ferrara claimed that ammonia volatilization is not the correct removal mechanism because this conclusion was based on the assumption that a steady-state condition existed, when, in fact, this was not the case in the pond studied. Ferrara used a time-variable approach to assess the relative magnitude of the mass transfer mechanisms for nitrogen in stabilization ponds. (Cassar-FRC)
W83-03573

FILTRATION OF PRIMARY EFFLUENT,
California Univ., Davis. Dept. of Civil Engineering.
M. R. Matsumoto, T. M. Galeziewski, G. Tchobanoglous, and D. S. Ross.
Journal of the Water Pollution Control Federation, Vol 54, No 12, p 1581-1591, December, 1982. 6 Fig, 4 Tab, 7 Ref.

Descriptors: *Filtration, *Wastewater treatment, *Biochemical oxygen demand, Oxygen demand, Effluents, Water quality, *Suspended solids, Pulsed-bed filters, *Filters.

The results of pilot designed to evaluate the feasibility of primary effluent filtration are presented. The objectives of the pilot studies were to determine the effectiveness of pulsed-bed filtration in reducing the suspended solids (SS) and biochemical oxygen demand of primary effluent, to determine the effects of using various sand sizes on the filtrate quality and filter run length, to determine the effects of varying hydraulic loading rates on the filtrate quality and filter run length, and to determine the long term performance of filters used for primary effluent filtration. The filtration of primary effluent with the pulsed bed filter appeared technically feasible. The SS removal efficiency for the filtration of primary effluent was a function of filter medium size and filtration rate. Above a sand size of 0.45 mm, filter performance was primarily a function of the filtration rate. The removal of BOD and SS were slightly related. A linear correlation was noted between these two parameters. The majority of BOD removed during the filtration of primary effluent was associated with the particulate BOD of the solids. The use of a chemical cleaning cycle is essential for successful long term filtration of primary effluent. Because the solids in backwash return water flocculate and settle rapidly, recycling of backwash water to the primary clarifer may be eliminated by using a small settling tank to separate the solids in the backwash water. The ability to filter primary effluent opens up many new possibilities for the treatment of wastewater. (Baker-FRC)
W83-03574

TREATMENT OF RAW WASTEWATER OVERFLOWS BY DISSOLVED-AIR FLOTATION,
Servicos de Engenharia Emilio Baumgart Ltd., Belo Horizonte (Brazil).
J. R. Bratby.
Journal of the Water Pollution Control Federation, Vol 54, No 12, p 1558-1565, December, 1982. 9 Fig, 1 Tab, 27 Ref.

Descriptors: *Wastewater treatment, *Dissolved air flotation, *Flotation, Water treatment, Seasonal variation, Design criteria, Wastewater treatment facilities, Brazil.

Treatment of raw wastewater excess flows by physical-chemical means is proposed, using dissolved air flotation for solid-liquid separation. Alum is the most appropriate coagulant for the present application. At a dose of 80 mg/l and a pH of 5.5, the efficiencies of removal of suspended solids, chemical oxygen demand, and phosphorus during flotation are 97, 84, and 92%, respectively. No flocculation is needed for efficient flotation. The minimum practicable air/solids ratio is 0.09. Within certain limits, the saturator pressure applied is immaterial, provided a given ratio of air to solids is maintained. Float solids concentrations of at least 8.3% are attainable by flotation; using lime to condition float solids, filter press concentrations of up to 40% are possible. Pilot plant filter press studies have shown that cake concentrations of 17% are attainable with float solids without conditioning. With conditioning, cake concentrations of 22% are attainable using polyelectrolyte. (Baker-FRC)
W83-03575

DISCUSSION OF: INDUSTRIAL WASTES AS CARBON SOURCES IN BIOLOGICAL DENITRIFICATION,
Canada Centre for Inland Waters, Burlington (Ontario).
T. R. Bridle.
Journal of the Water Pollution Control Federation, Vol 54, No 12, p 1613, December, 1982. 1 Tab, 7 Ref.

Descriptors: *Nitrogen removal, *Denitrification, Industrial wastes, *Wastewater treatment, Biological treatment, Methanol, Organic wastes.

The low denitrification efficiencies achieved with whey in J. R. Skrinde and S. K. Bhagat's study of industrial wastes as carbon sources for denitrification, Journal of the Water Pollution Control Federation, Vol 54, page 4, 1982, were probably a result of a too-low influent COD/N ratio. Environment Canada's Wastewater Technical Center studied 30 industrial wastes as carbon sources for denitrification and found that 27 produced denitrification rates better than those achieved with methanol as the carbon source. Using pre-denitrification would further improve the nitrogen removal process by reducing oxygen requirements, the need for supplemental carbon sources, and alkalinity requirements. (Cassar-FRC)
W83-03576

ATMOSPHERIC RELEASE OF CHLORINATED ORGANIC COMPOUNDS FROM THE ACTIVATED SLUDGE PROCESS,
Air Force Occupational and Environmental Health Lab., Brooks AFB, TX.
P. A. Lurker, C. S. Clark, and V. J. Elia.
Journal of the Water Pollution Control Federation, Vol 54, No 12, p 1566-1573, December, 1982. 2 Fig, 5 Tab, 16 Ref.

Descriptors: *Wastewater treatment, *Activated sludge process, *Organic compounds, *Source of pollutants, Fate of pollutants, Hexachlorobicycloheptadiene, Heptachlorobicyclopheptene, Chlordene, Industrial wastes, Digestion, Stabilization, Aeration basins.

Atmospheric release of chlorinated organic compounds from the activated sludge wastewater treatment process at the North plant in Memphis, Tennessee was demonstrated by field monitoring studies. The highest wastewater concentrations of the test compounds, hexachlorobicycloheptadiene, Heptachlorobicycloheptene, and chlordene, which entered the plant as components of industrial wastes, were found at the aeration basins. Comparisons of the airborne concentrations of these substances at the different aeration basin types, the contact, stabilization, and digestion indicated higher release from the contact and stabilization basins. Estimation of emission rates applying atmospheric dispersion models revealed that about 52% of hexachlorobicycloheptadiene, 21% of heptachlorobicycloheptene, and 0.61% of chlordene were released at the contact aeration basin. The demonstrated release of these contaminants suggests that more attention should be given to the air stripping of other toxic compounds at wastewater treatment plants. (Baker-FRC)
W83-03583

ENZYMATIC PRETREATMENT OF PULP MILL EFFLUENTS PRIOR TO DECOLORIZATION BY LIME PRECIPITATION,
North Carolina State Univ. at Raleigh. Dept. of Wood and Paper Science.
J. C. Campbell, and T. W. Joyce.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-235457, Price codes: A05 in paper copy, A01 in microfiche. Water Resources Research Institute Report No 197, Raleigh, May, 1983. 88 p, 22 Fig, 4 Tab, 58 Ref.

Descriptors: *Pulp and paper industry, Effluents, *Color removal, *Wastewater Treatement, Water pollution prevention, Lime, *Enzymes, Pollutants color, Industrial wastes, Bleaching wastes, Pulp wastes.

The lime precipitation process for removal of color from pulp mill effluents is a function of the molecular weight of the color molecules. Pretreatment to increase the proportion of high molecular weight color molecules could increase the efficiency of

this process. In this study, the phenol oxidase laccase was examined for its potential use as a pretreatment to increase color removal by lime. The enzyme laccase was produced in laboratory cultures of the white-rot fungus Coriolus versicolor. The concentrated culture media were used for eight-hour pretreatments of three types of effluent over a range of pH levels. Results from pretreatments of biologically-treated whole-mill effluent (BTE) showed only a limited improvement in color removal by lime. Attempts were made to improve the pretreatment by spiking BTE with o-cresol, a substrate for enzymatic reactions. However, the increase using cresol was not great enough for commercial significance. Laccase increased color removal from chlorination stage effluent to a maximum of 69%, compared to 57% for the control. Neither laccase nor laccase and cresol increased color removal from caustic extraction stage effluent. In general, pretreatment of pulp mill effluents with laccase prior to lime addition gave limited improvements in color removal efficiency. None of the increases in color removal was considered to be of the magnitude required for industrial importance.
W83-03603

INDUSTRIAL WATER REUSE WITH COUPLED-TRANSPORT MEMBRANES,
Bend Research, Inc., OR.
W. C. Babcock.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-235465, Price codes: A03 in paper copy, A01 in microfiche. Completion Report OWR/RU-83-3, U.S. Dept. of the Interior, Bur. Reclamation, Washington, DC, May 1983, 35 p, 19 Fig, 3 Tab, 8 Ref. OWRT C-00194-R(No 0536)(1).

Descriptors: *Membranes, *Membrane processes, *Metal-finishing wastes, *Water reuse, *Wastewater treatment, Field tests, Distillation, Economic feasibility, Plating wastes, Rinse water, *Coupled transport, Chrome plating, Payback periods.

The program objective was to demonstrate the feasibility of using coupled-transport membranes to treat chrome-plating rinse waters. This year's efforts were directed toward field tests of small hollow-fiber-membrane units at a decorative-chrome plating shop and at a hard-chrome plating shop. Field tests at the decorative-chrome shop were conducted with a unit containing modules with 15 ft super 2 of membrane. These modules exhibited fluxes of 5 lb/ft super 2 -year and showed no deterioration in performance over the longest test (125 days). Field tests in a hard-chrome shop were also performed with 15-ft super 2 modules, but were limited to only 2 weeks due to problems caused by precipitation of iron hydroxide in the unit that fouled the modules and fibers. Based on the field-test results, an economic analysis was performed. The results show that coupled-transport treatment of decorative-chrome rinse water is economically attractive compared with distillation, which is currently used to a limited extent in the plating industry to recover chromium from rinse waters and to produce reusable rinse water. For example, a unit that will recover 5000 pounds of chromium per year will have a payback of 2.25 years, compared with a payback period of 6 years for a comparably sized distillation unit.
W83-03604

ENUMERATION OF CHLORINE-DAMAGED FECAL COLIFORMS IN WASTEWATER EFFLUENTS,
Illinois Univ. at the Medical Center, Chicago. School of Public Health.
P. J. Graham, and G. R. Brenniman.
Journal of the Water Pollution Control Federation, Vol 55, No 2, p 164-169, February, 1983. 3 Fig, 4 Tab, 27 Ref.

Descriptors: *Bacteria, *Chlorination, *Wastewater analysis, Pollutant identification, *Coliforms, Filtration, *Wastewater treatment.

Media enrichment significantly improved recovery of fecal coliforms in the conventional membrane filtration (MF) method when used to analyze samples collected at four stages of treatment in an advanced wastewater treatment plant which chlorinated the final effluent. However, this experiment did not conclusively prove that recovery rates for chlorine-damaged cells had improved. Median concentrations of fecal coliforms (cells per 100 ml) determined during the four treatment steps were: settling tank, 20,000 control and 36,000 enrichment; postchlorination, 48 control and 60 enrichment; postfiltration, 900 control and 860 enrichment; and outfall, 200 control and 400 enrichment. Chlorine residuals (mg per liter) were 2.46 in the post-chlorination stage, 0.28 after filtration, and 0.16 at the outfall, 2 miles from the plant. The aftergrowth of the bacteria was attributed to self repair of the chlorine-damaged cells and not to multiplication in the filter media. (Cassar-FRC)
W83-03632

HOW MUCH PREVENTIVE MAINTENANCE IS TOO MUCH,
G. Mellish, and C. R. Beer.
Journal of the American Water Works Association, Vol 75, No 1, p 14-15, January, 1983.

Descriptors: *Decision making, *Maintenance, *Maintenance costs, *Water management, Management planning, Wastewater treatment, Water treatment, Operating costs, Safety, Hydraulic equipment, Preventive maintenance, Wastewater treatment plants.

In a discussion of how much preventive maintenance (PM) should be included in the operation of a wastewater treatment plant, Gordon Mellish, supervisor of instrumentation of a sewage treatment plant in Toledo, Ohio and Charles R. Beer, superintendent of water treatment for the Denver Water Department, present differing viewpoints. Mellish contends that unless a PM program is realistic, it is not cost effective. To back his argument he states that his plant's magnetic flow meters and stepping switches did not require the recommended maintenance schedule suggested by the manufacturer. In addition, the routine replacement of vacuum tubes often resulted in the insertion off the wrong tubes into the sockets, causing detuning or oscillating the amplifier circuits. If maintenance checks become too tedious, Mellish believes technicians are apt to perform their jobs poorly. PM programs that replace parts that already work are too costly and any routine maintenance should be performed on a time schedule determined by actual experience with the equipment. Mr. Beer, on the other hand, believes that PM is necessary because the services provided by a water treatment plant are too important to risk downtime of equipment. Beer contends that maintenance technicians will become more familiar with the equipment, the more they inspect and repair it. Accurate records of all equipment, parts in stock, and maintenance should be kept along with a file of hard-to-get critical parts. The choice of how much PM and corrective maintenance should be performed is clearly a management decision and should be based on not only cost, but what value is placed on reliability, employee safety, and product quality. If the PM program remains flexible then better choices can be made as experience increases. (Geiger-FRC)
W83-03638

REMOVAL MECHANISMS FOR TOXIC PRIORITY POLLUTANTS,
Oklahoma State Univ., Stillwater. School of Civil Engineering.
D. F. Kincannon, E. L. Stover, V. Nichols, and D. Medley.
Journal of the Water Pollution Control Federation, Vol 55, No 2, p 157-163, February, 1983. 6 Fig, 4 Tab, 5 Ref.

Descriptors: *Organic compounds, *Priority pollutants, *Degradation, *Wastewater treatment, Activated sludge process, Biodegradation, Adsorption, Ozonation, Stripping, Oxidation, Biological wastewater treatment, Toxicity.

Removal of a variety of priority pollutants was studied in a complete-mix, continuous flow activated sludge system, a batch reactor, and an ozonation system. In the continuous flow system removal efficiencies of 94.5->99% were attained for the 15 chemicals tested: tetrachloroethane, nitrobenzene, 2,4-dinitrophenol, acrolein, acrylonitrile, 1,2-dichloropropane, methylene chloride, ethyl acetate, benzene, 1,2-dichloroethane, phenol, 1,2-dichlorobenzene, 1,1,1-trichloroethane, 1,3-dichlorobenzene, and 2,4-dinitrophenol. Initial concentrations of the pollutants were 62-258 mg per liter. Either stripping or biodegradation, and in some cases, a combination of the two, was the effective destruction method for all compounds; sorption had an almost negligible role. In batch studies, acrylonitrile (110 mg per liter) was 99.1% removed by a combination of stripping and biodegradation. Likewise, 130 mg per liter 2,4-dinitrophenol was 63% removed and 100 mg per liter phenol was 99% removed, both totally by biodegradation. Ozone treatment made 1,2 dichloropropane biodegradable, slightly increased the biodegradability of 2,4-dinitrophenol, and decreased the biodegradability of acrylonitrile. In general, nitrogen compounds, phenols, and oxygenated compounds were removed by biodegradation; aromatics, by stripping-biodegradation; and halogenated hydrocarbons, by stripping. (Cassar-FRC)
W83-03647

THE MASONRY SEWERS OF ALEPPO,
Engineering-Science, Inc., Arcadia, CA.
R. M. Bradley, and A. Hajjar.
Journal of the Institution of Water Engineers and Scientists, Vol 36, No 6, p 437-446, December, 1982. 5 Fig, 8 Ref.

Descriptors: Wastewater collection, *Sewer systems, *Maintenance, Aleppo, *Syria, Concretes, Roughness coefficient, Cleaning, Sewer infiltration, Infiltration, *Masonry sewers.

The city of Aleppo, Syria, reputed to be the oldest continuously inhabited city in the world, has a sewer system at least 1500 years old. The system, which serves 80% of the 1 million population, is composed of 48 km of interceptor sewers and 640 km of street sewers. The sewer network, constructed of local limestone masonry blocks, operates entirely without pumping. Most sewers are rectangular, but some are of horseshoe or ovoid shape. Problems with the system include a high roughness coefficient (Manning n of 0.02), high infiltration rate, poor hydraulic characteristics in the rectangular cross sections, and frequent structural failure from increasingly heavy traffic. Maintenance and cleaning are all done by manual labor. Wastewater is relatively high in inorganic matter from washing root vegetables and from sand washed from roads and yards. The rate of corrosion from the 30-40 mg per liter sulfate and 4 mg per liter sulfide was calculated to be 0.085 mm per year, about 5 times less than for concrete sewers. The present method of sewer construction will probably be continued until concrete pipe can be manufactured locally at a competitive price. Wastewater is not treated, but is discharged to the river, which is used for irrigation. (Cassar-FRC)
W83-03655

PRELIMINARY EVALUATION OF THE PRETREATMENT OF FUEL ALCOHOL FERMENTATION STILLAGE THROUGH AN ANAEROBIC FILTER,
Missouri Univ.-Rolla. Dept. of Civil Engineering.
R. B. Jacquez, A. Sales, and W. M. Wang.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-243030, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Center Completion Report, Univ. of Missouri, Columbia, November 1982. 27 p, 3 Fig, 5 Tab, 14 Ref. A-124-MO(1), 14-34-0001-1127.

Descriptors: Anaerobic conditions, *Filter, *Packed bed, *Alcohols, *Wastewater treatment, *Industrial wastes, *Anaerobic bacteria, *Anaerobic digestion, Water pollution control, Methane, Chemical oxygen demand, Biochemical oxygen demand, Nutrients, Nitrogen, Phosphorus, Fermentation.

The objective of this research was to conduct a preliminary evaluation of the pretreatment of fuel alcohol fermentation stillage by means of an anaerobic filter. The first phase of the investigation was devoted to characterizing the stillage. The following observations were made based upon the characteristics: (1) the organic strength of the stillage (COD=59, 500 mg/1, BOD sub 5=26,700 mg/1) was approximately 100 times that of municipal wastewater; (2) the stillage was deficient in nitrogen (BOD:N:P=100:0.6:1.4), an essential nutrient required for satisfactory biological decomposition; (3) the pH of the stillage is acidic (pH=3.7); and (4) the suspended solids of the stillage is exceptionally high (SS=10,500 mg/1). The second phase of the investigation studied the reduction of suspended solids by centrifugation. A centrifugation speed of 1000 rpm for five minutes was demonstrated to optimize suspended solids removal (91% removal). In the third phase of the investigation laboratory scale anaerobic filters were tested as a means of pretreating the fermentation stillage. Prior to being used as the filter feed, the stillage was centrifuged to remove suspended solids, neutralized to pH 7.0, and was supplemented with nitrogen to a BOD:N:P ratio of 100:5:1. The filters were operated at organic loads ranging from 32 to 214 lbs COD/1000 ft super 3/day which produced operating efficiencies of 49-94% COD removal. Methane gas production ranged between 4.4 to 10.5 ft super 3 CH sub 4/lb COD destroyed. Overall, the anaerobic filter was demonstrated to be an effective means of pretreating fermentation stillage.
W83-03664

THE USE OF FIELD CROP RESIDUES FOR SAND FILTER MODIFICATION OF SMALL COMMUNITY WASTEWATER STABILIZATION PONDS TO MEET SECONDARY TREATMENT REQUIREMENTS AND RECOVERY OF PLANT NUTRIENT RESOURCES,
Missouri Univ.-Rolla. Dept. of Civil Engineering.
D. E. Modesitt, and S. G. Swanback.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-243048, Price codes: A03 in paper copy, A01 in microfiche. Missouri Water Resources Research Center Completion Report, Univ. of Missouri, Columbia, November 1981. 39 p, 10 Fig, 1 Tab, 15 Ref. A-126-MO(1), 14-34-0001-1127.

Descriptors: *Oxidation lagoons, *Sewage lagoons, Sewage effluents, *Filters *Wastewater treatment, Water pollution control, Biochemical oxygen demand, Chemical oxygen demand, Nitrogen, Phosphorous, *Filtration, Field Crops(residue), Harvesting of algae, *Sand filters.

Comparisons were made of laboratory scale intermittent sand filters for upgrading wastewater lagoon effluent. Three filters were used. Two were modified with a 45.7 cm (18 in) cover of corn stalks or sunflower stalks. The hydraulic loading rate 4700 m super 3. ha/d (0.5 mgad) applied in two equal doses daily. The effective sand size was 0.18 mm. The lagoon effluent characteristics during the study period averaged 102 mg/l SS, 42 mg/l BOD sub 5, 169 mg/l COD, 11.4 mg/l TKN, and 2.7 mg/l total P. The filters were operated 57 days before the corn stalk covered filter clogged. All filter effluents averaged less than 30 mg/l BOD sub 5 (13.5 - 18 mg/l). Only the corn stalk covered filter averaged less than 30 mg/l SS (23 mg/l). The unmodified filter effluent had the greatest SS (44 mg/l average). Effluent COD values were similar (68 to 76 mg/l). TKN values were 1.5 mg/l for unmodified filter and 3.6 mg/l for the one with corn stalks. The lowest average total P (1.0 mg/l) was produced by the corn stalk covered filter. No significant recovery of P or N was achieved on the crop residue. Modification of intermittent sand filters may provide increased pollutant reduction.
W83-03665

AN INNOVATIVE APPROACH OF OPERATING ROTATING BIOLOGICAL CONTACTOR USING PURE OXYGEN,
Missouri Water Resources Research Center, Columbia.
J. C. Huang, C. E. McCann, and Y. C. Liu.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-243055, Price codes: A03 in paper copy, A01 in microfiche. Completion Report, November 1982. 33 p, 6 Fig, 2 Tab, 18 Ref. A-123-MO(1), 14-34-0001-1127 and 2127.

Descriptors: *Biological treatment, *Oxygenation, *Wastewater treatment, Microbial activity, *Rotating biological contactor, *Biodiscs, Films, Waste stabilization, Fixed films.

Three laboratory-scale rotating biological contactors (RBC) were used to evaluate the effect of oxygen availability on the microbial buildup and the related waste stabilization activity in the RBC system. One of the RBC units was exposed to air while the other two were subjected to pure-oxygen inputs at 146 and 365 g 0 sub 2/m super 2/day, respectively. The three units were operated in parallel and three different organic laoding rates, 82.5, 150 and 310 g COD/m super 2/day, were imposed in separate experimental runs. The results of this study have shown that not only the amount of microbial buildup is affected by the oxygen input, but the waste stabilization activity per unit biomass is also dictated by the oxygen availability. It has also been observed that about 70 to 80% of the total biomass in an RBC system exists as the fixed film while the remaining 20 to 30% exists as the suspended biological flocs. With a fixed film thickness of 5 to 6 mm, an aerobic condition cannot be maintained throughout the attached-growth layer when the DO in the mixed liquor is below 3 or 4 mg/l. If the biomass inside an RBC system is kept thoroughly aerobic, the biomass can achieve a specific COD reduction rate of 0.96 g COD/day/g VS when the F/M ratio is equal to 1.0. On the contrary, if the biomass is under either an anoxic or an anaerobic condition, its waste stabilization activity would be reduced by about one-third, or equivalent to having a specific COD reduction rate of 0.62 g COD/day/g VS.
W83-03666

DISPOSAL OF HOUSEHOLD WASTEWATER IN SOILS OF HIGH STONE CONTENT,
Arkansas Univ., Fayetteville. Dept. of Agronomy.
E. M. Rutledge, C. R. Mote, M. S. Hirsch, H. D. Scott, and D. T. Mitchell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-243188, Price codes: A07 in paper copy, A01 in microfiche. Water Resources Research Center Publication No 99, Univ. of Arkansas, Fayetteville, May 1983. 140 p, 22 Fig, 11 Tab, 53 Ref, 1 Append. OWRT B-052-ARK(1), 14-34-0001-1204.

Descriptors: *Septic tank systems, Filter fields, *Soil adsorption systems, Effluent renovation, Septic tank effluent treatment, Frgiudults, Loamy-skeltal soils, Soils-stony, Climatic stress periods, *Filters, *Wastewater treatment, *Wastewater disposal.

Two experimental septic tank filter fields were constructed with built-in monitoring equipment in Nixa soils. These soils contain many chert fragments and a fragipan about 60 cm deep which restricts downward water movement and is the design-limiting feature. The standard filter field (76 cm deep) was built into the fragipan and the modified standard filter field (30 cm deep) was placed above it. During 30 months observation, the modified standard performed better than the standard filter field. Maximum rise of effluent in the standard and modified standard came within 11 and 19 cm of the soil surface, respectively. Performance of these systems indicates filter fields should be designed to function during climatic stresses, i.e., when the soil has a maximum hydraulic load and surfacing may occur. Filter fields should be designed to withstand a stress period of specified intensity. The filter fields in this study were observed under less than normal stress. Therefore, their long range performance is less clear. Our observations indicate that filter field performance is related more to rates of water movement than to stone content. Major influences on filter field performance are rates and directions of water movement, stress period intensity, designs and construction techniques.
W83-03679

BIOLOGICAL TREATMENT OF CYANIDE IN HIGH-STRENGTH COKE-PLANT WASTEWATER,
Alabama Univ. in Birmingham. Dept. of Biology.
D. D. Jones.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-246462, Price codes: A02 in paper copy, A01 in microfiche. Water Resources Research Institute Compeletion Report, Auburn Univ., Ala., July 1983. 4 p. OWRT A-084-ALA(1), 14-34-0001-2101.

Descriptors: *Coke-plant wastewater, *Wastewater treatment, *Cyanide, *Biological treatment, Bulking sludge, Filamentous growth, Ammonia liquor.

Coke-plant wastewater contains a variety of compounds including phenol (300-4000 mg/l), ammonia (1300-2000 mg/l), cyanide (10-100 mg/l) and thiocyanate (10-100 mg/l). Wastewater tratment plants have microbial populatins adapted to treat wastewater processed in an ammonia still to reduce the concentration of toxic constituents, particularly ammonia and cyanide. A microbial population already adapted to treating coke-plant wastewater subjected to steam stripping was further acclimated to treat a wastewater containing an average of 350 mg/l TOC (250 mg/l phenol), 40 mg/l thiocyanate, 175 mg/l ammonia and 200 mg/l cyanide fed to bench-scale reactors at a hydraulic retention time of 42 hours. The reactor was operated at a solids retention time of 50 days and a temperature of 35C. The mixed liquor suspended solids decreased from 3000 mg/l to approximately 1000 mg/l after 230 days operation. The nitrifying bacteria did not become significantly more tolerant to cyanide in the complete-mix system since the cyanide degraders provided protection from the inhibiting effects of cyanide. Phenol and thiocyanate removal were unaffected by additions of cyanide. High organic loadings (TOC, 1000 mg/l) of coke-plant wastewater led to the development of filamentous growth and bulking sludge. Once established, such treatments as alkaline pH, exposure to hydrogen peroxide, and wasting of the biomass at a 4% or greater rate did not reduce the filamentous population. Operating at elevated temperatures (42C) effectively reduces the filamentous growth and improves settleability while maintaining good effluent quality. The primary difficulty in treating high-strength coke-plant wastewater appears to be the general toxicity that occurs at higher organic loadings that decreases the microbial efficiency.
W83-03697

WASTE WATER TREATMENT BY LIGAND EXCHANGE,
Louisiana State Univ., Baton Rouge. Dept. of Chemical Engineering.
F. R. Groves, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-246553, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Institute Completion Report, June 1983. 22 p, 17 Fig, 5 Tab, 16 Ref. OWRT A-055-LA(1), 14-34-0001-2120.

Descriptors: Ammonia, Aqueous waste, *Ion exchange, *Ligand exchange, *Wastewater treatment, Amines, Phenols, Resins, Wastewater treatment facilities.

Ligand exchange is a water purification process in which a pollutant is removed by complexing with an ion held on an ion exchange resin. The objective of this research was to explore the use of ligand exchange for removal of ammonia, amines, and phenols from dilute (150 mg/L aqueous solution). Ammonia and amines were successfully removed by complexing with copper (II) ion held on a cation exchange resin. Breakthrough curves and equilibrium curves were obtained experimentally for ammonia, ethylamine, diethylamine, ethanolamine, and butyl amine on the copper (II) - Amberlite IRC-50 resin system. The ammonia data were successfully correlated by a mathematical model of the ligand exchange process. An attempt was made to treat dilute solutions of phenol, resorcinol, and pyrogallol by complexing with borate held on two kinds of resins. Ligand exchange was unsuccessful

for this application. The phenols displaced th borate and were held irreversibly on the resin. A preliminary economic study was done for a ligand exchange plant to treat one million gallons per day of water containing 150 mg/L of ammonia. Based on use of exhaust steam as a heat source for regeneration a treatment cost of $0.285 per thousand gallons was determined. Ligand exchange should be competitive with such processes as activated carbon adsorption and conventional ion exchange.
W83-03706

ADAPTATION OF AN ACTIVATED SLUDGE PROCESS TO THE TREATMENT OF COKE-PLANT WASTEWATER CONTAINING HIGH LEVELS OF CYANIDE,
Alabama Univ. in Birmingham. Dept. of Biology.
D. Harden.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-246942, Price codes: A05 in paper copy, A01 in microfiche.
M. S. Thesis, University of Alabama, Birmingham, 1983. 75 p, 10 Fig, 13 Tab, 37 Ref. OWRT A-084-ALA, 14-34-0001-2101.

Descriptors: *Cyanide, *Wastewater treatment, Wastewater, *Biological wastewater treatment, Industrial wastewater, Sludge, *Activated sludge.

Cyanide occurs in the wastewater of a variety of industries, particularly those involved in steel production, metal plating, coal gasification and in the manufacture of chemicals, plastics and pharmaceuticals. Because of its toxicity, cyanide is generally removed from wastewaters by chemical and physical methods, including alkaline chlorination, complexation and aidification, prior to biological treatment. It is now apparent that in some cases wastewater containing cyanide can be treated using conventional biological processes. One major goal of this research was to determine whether a microbial population treating coke-plant wastewater could be adapted to treat high levels of cyanide influent. A second major goal was to determine what measurable differences exist after adaptation between a population receiving high levels of influent cyanide and one receiving low levels. Methods of comparison included oxygen utilization and viable plate counts in the presence of cyanide, as well as measurements of nitrification and phenol removal in the presence of cyanide. The final goal of this research was to determine some of the characteristics of the organisms responsible for cyanide degradation in the coke-plant wastewater treatment environment.
W83-03710

PHASE AND COMPRESSION BEHAVIOR IN SEDIMENTATION AND THICKENING OF LIQUID-SOLID SUSPENSIONS,
Auburn Univ., AL. Dept. of Chemical Engineering.
T. D. Placek.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-249664, Price codes: A02 in paper copy, A01 in microfiche.
Completion report, July 13, 1983. 12 p, 1 Fig, 1 Tab, 7 Ref. OWRT A-086-ALA(1), 14-34-0001-2101.

Descriptors: *Sludge thickening, *Wastewater treatment, *Model studies, Mathematical analysis, Flocculation, Settling basins.

Theoretical work has recently been to allow batch settling data to be more successfully used to design continuous thickening process equipment particularly at medium to high solids concentrations. The model developed allows the mathematical description of clarifiers and thickeners operating in the compression zone regime. This work was conducted to obtain the required data to both validate the new model as well as to compare its reliability to other currently used models such as Oltmann, Talmage and Fitch, Wilhelm and Naide, and Coe and Clevenger. Additional experimental work was performed to investigate to what extent batch and continuous thickeners are affected by rheological variants such as shear history and surface effects as well as to consider the significance of phase behavior such as channelling. Laboratory work included the construction of a prototype continuous thickener having excellent performance characteristics as well as making refinements in the standard data collection and treatment methods.
W83-03727

COMPARATIVE EVALUATION OF MATHEMATICAL MODELS USED FOR CALCULATING BIOLOGICAL FILTERS,
Akademiya Nauk SSSR, Moscow. Inst. Vodnykh Problem.
V. A. Vavilin, and S. S. Kuz'min.
Water Resources (English Translation), Vol 9, No 2, p 193-199, March-April, 1982. 1 Fig, 2 Tab, 18 Ref. Translated from Vodnye Resursy, No 2, p 109-115, March-April, 1982.

Descriptors: *Mathematical models, *Wastewater treatment, *Biofilters, Filtration, Oxidation, Bacteria, Mass transfer, Substrates, Filters.

The processes of oxidation of individual substrates or pollutants and of multicomponent pollutants such as wastewaters are examined. When describing the process of biochemical oxidation of monosubstrates a sufficiently adequate model of the biofilter is the Monod-type model, the limiting cases of which are described by equations of zeroth and first order reactions. The constant of the Monod model as well as the rate constant of the zeroth and first order reaction can be estimated from the diffusion model of oxidation of a monosubstrate by a biofilm. For multicomponent pollutants such as wastewaters the most adequate to the prototype are not classical models of the Monod type but rather models of higher orders of the reaction. (Baker-FRC)
W83-03735

HARVESTING OF ALGAE GROWN ON RAW SEWAGE,
National Inst. for Water Research, Pretoria (South Africa).
J. M. P. Viviers, and J. H. Briers.
Water SA, Vol 8, No 4, p 178-186, 1982. 6 Fig, 8 Tab, 13 Ref.

Descriptors: *Algae harvesting, *Dewatering, *Aqua culture, Algal growth, Sewage, Sludge dewatering, *Wastewater treatment, Nutrients, *Flotation.

Results pertaining to the definition and optimization of some of the engineering parameters which are important for the practical implementation of the harvesting of algae grown on raw sewage are reviewed. Harvesting comprises three separate but interdependent processes: separation, dewatering and drying. Three flotation techniques, dissolved air flotation (DAF), dissolved oxygen flotation (DOF) and induced air flotation (IAF), were compared for separation. An algal production pond of 260 square meters was operated with raw sewage. DAF in conjunction with aluminum sulfate as flocculant yielded a slurry containing 2 to 3% dry solids; with a cationic polyelectrolyte (Praestol 444K) a slurry containing up to 8% dry solids was obtained. The latter slurry showed superior dewatering characteristics in comparison with the alum derived slurry. Retention of the float layer in the cell for more than one hour before scraping results in a biomass concentration of up to 8% solids, which represents an improvement of about 60% over continuous scraping. The polyelectrolyte sludge is amenable to further dewatering on a screen, resulting in a solids concentration of up to 12%. Drum drying of the algal sludge resulted in a final product containing up to 56% protein, putting it in line with soya bean and fish meal in terms of quality. An estimated initial capital outlay saving of 25% is possible on utilizing the DOF technique, with a possible 11 to 12% savings on running costs, as compared with DAF, which requires air/water saturation. (Baker-FRC)
W83-03737

THE MODULAR APPROACH TO SEWAGE TREATMENT.
Water Services, Vol 86, No 1041, p 544-545, 547, 1982.

Descriptors: *Wastewater treatment, *Sludge blanket, Sludge, Suspended solids, Modular approach.

A modular system is now being marketed which is able to monitor most of the common parameters found in water and sewage treatment. An original one-shot multi-vibrator sensing the cutting off of transmitted light by a rising sludge blanket is used to trip a sequence of lights and relay contacts to give visual and audible warning of a rising blanket. The system was experiencing some difficulty. After a period of trials and development a two-light source system, each with an independent receiver gathering some scattered and some direct light, was fed into an AND gate IC, thus requiring all light sources to be occluded before the warning trips were activated. The sensor is mounted on the end of heavy duty screened cable which has level indications marked every half meter, and this is itself suspended on a boom in the tank, usually on the revolving gantry. A separate relay contact is supplied in the weatherproof housing, with the main amplifier and power supply unit, so that a telemetry link may be used to feed the information back to a central receiving laboratory. A further design using a remote IR transmitter/receiver system is now under consideration. (Baker-FRC)
W83-03741

TOTAL WATER MANAGEMENT--THE DENVER STORY,
CH2M/Hill, Denver, CO. Water Engineering Dept.
K. J. Miller.
Public Works, Vol 114, No 2, p 38-39, February, 1983. 1 Fig.

Descriptors: *Water reuse, *Irrigation water, *Reclaimed water, Denver, *Colorado, Water treatment, Water distribution, Wastewater treatment, Water reuse.

Several communities in Colorado use treated wastewater effluent for irrigation of golf courses and landscape plantings. Denver is installing a plant to produce potable water from wastewater as part of its water distribution system expansion, which also includes a 300 ft high diversion dam and a 3.4 mile diversion tunnel. The pilot plant reuse facility consists of primary and secondary treatment, chemical coagulation and settling, carbon dioxide neutralization, filtration, ammonia extraction, organic chemical removal by activated carbon adsorption in two steps, ozonation, demineralization, aeration, and disinfection with chlorine dioxide. For the next 5-7 years water quality will be monitored for 200 potentially harmful viruses, bacteria, and chemicals. (Cassar-FRC)
W83-03746

BUILDING SEWER RENOVATION--A KEY TO SUCCESSFUL I/I CONTROL,
C. H. Steketee, and R. Beck.
Public Works, Vol 114, No 1, p 46-50, January, 1983. 2 Fig.

Descriptors: *Sewer systems, *Rehabilitation, *Sewer infiltration, Leakage, Grouting, Inspection, Infiltration, Lateral sewers.

Repair of building laterals was an important factor in reducing infiltration/inflow (I/I) in several sewer systems. Castle Rock, Washington, population 2000, reduced I/I by 60% by replacing the many deteriorated laterals and grouting all the major I/I contributing areas in the main sewers. In a 67-home pilot program at Salem, Oregon, 28 of 31 building sewers failed an air test. All but 3 were repaired without excavation. Problems in handling building sewer inspection and repair are divided ownership and construction responsibilities, difficult access, inadequacy of leak detection methods (smoke tests or TV inspection), and poor construction of main connections. Some methods used for repairing leaky building laterals include plug and grout, sock sleeve packers, sliplining with polyethylene pipe, and a snake. (Cassar-FRC)
W83-03747

COLUMN DESIGN FOR RECOVERY OF NH3 AND CO2 FROM WASTEWATER IN A UREA PLANT,

Clarkson Coll. of Technology, Potsdam, NY. Dept. of Chemical Engineering.
R. H. Weiland, and J. Litster.

Separation Science and Technology, Vol 16, No 10, p 1339-1354, 1981. 2 Fig, 2 Tab, 19 Ref.

Descriptors: *Chemical recovery, *Wastewater treatment, *industrial wastewater, *Ammonia, *Carbon dioxide, *Urea, Chemical reactions, Chemical industry, Design criteria, Model studies, Separation techniques, Mass transfer, Energy, Ammonium compounds, Heating.

A sequential section-to-section calculation procedure is proposed for the stripping of carbon dioxide and ammonia from a chemically reactive dilute aqueous solution in a packed column, where the gases are present mostly as ammonium carbamate which decomposes under heating. The need to recover these gases from a wastewater stream from a urea plant containing up to 3% of each gas motivated the study. Analysis of the stripping process is based on a film model. Several pilot-scale experiments were conducted to validate the model. The model was programmed to predict column height required to produce a specified lean bottoms composition from a given feed concentration and rate when column operating pressure and overhead vapor rate are stipulated. For each section, mass and energy balances were determined, and calculations proceeded sequentially from section to section. Iterative calculation was used within sections to establish mass transfer rates. Comparison of predicted and experimental column height required to perform six separations showed that the experimental packed height was 1.64 m, while the predicted height was 1.52 m with a standard deviation of plus or minus 0.23 m (15%). Section-to-section models are preferrable to block tridiagonal matrix formulations where flows and compositions can be completely specified for the feed and closely estimated for overhead vapor. Use of a fundamental or mechanistic model makes optimization of column design possible. (Gish-FRC)
W83-03748

SUB-SURFACE AERATOR/MIXING UNITS.

Water Services, Vol 86, No 1041, p 549, 553, 1982. 1 Fig.

Descriptors: *Activated sludge processes, *Wastewater treatment, Wastewater treatment facilities, *Aeration, Oxidation, Oxygen, Helixor, Reservoirs, Destratification.

Sub-surface aerator/mixing units are extremely versatile. Representative units of this type, Helixors, were first used as submerged aerators/mixers in wastewater treatment lagoons as well as in lakes and reservoirs to overcome thermal stratification and the related problem of depleted oxygen levels. Such systems are now incorporated in conventional and extended aeration activated sludge plants, balance tank and pH control facilities, anaerobic and aerobic digester sludge mixing, reservoir destratification, oxidation of sulfides and phenols. Three basic engineering principles of oxygen transfer are employed: large interfacial contact, provided by small air bubbles; prolonged interfacial contact, provided by the helix component causing the mixture of air and water to travel more than twice the distance of the height; and turbulent flow provided by spiral velocities in excess of 1.25 m/sec. The Helixor's ability to life vast quantities of liquor ensures maximum mixing of the polluting material and microorganisms. (Baker-FRC)
W83-03763

INDUSTRIAL WASTEWATER PRETREATMENT STANDARDS--A LOCAL APPROACH,

Burns and McDonnell, Kansas City, MO.

For primary bibliographic entry see Field 6F.
W83-03765

WATER QUALITY IN THE FIRTH OF FORTH,

Napier Coll., Edinburgh (Scotland). Dept. of Biological Sciences.
P. A. Read, K. J. Anderson, J. E. Matthews, P. G. Watson, and M. C. Halliday.

Marine Pollution Bulletin, Vol 13, No 12, p 421-425, December, 1982. 4 Fig, 2 Tab, 30 Ref.

Descriptors: *Water quality, *Wastewater treatment, Outfalls, Outfall sewers, Sediments, Metals, Mussels, Firth of Forth, Edinburgh, Primary wastewater treatment, *Scotland.

In the Firth of Forth a long term monitoring program has been undertaken to assess the environmental impact of a new sewage treatment scheme for the City of Edinburgh. Water quality along the Edinburgh coastal zone was tested in terms of selected chemical parameters. The ecology of Edinburgh coastal zone was investigated by means of studies of plants and animal populations of the foreshore and to determine the reasons for any changes detected. The fecal contamination of sea water was also examined, and shellfish were studied using bacterial indicators. Techniques for isolating viruses from polluted sea water and shellfish were used to study viral contamination along the coastal zone. Techniques were established to analyzed low concentrations of heavy metals in sea water, sediments and marine organisms, and these techniques were used to investigate heavy metal contamination along the coastal zone. A significant improvement has been noted in the water quality and environmental quality of the south shore of the outer Firth of Forth, most notably along the Edinburgh coastal zone since the opening of the primary sewage treatment works, complete with long sea outfall in 1978. A marked drop was noted in fecal pollution of sea water along the coastal zone. Levels of trace metals in sediments, sea water and mussels in the area has been found to be generally of the same order as in other estuaries of the United Kingdom. (Baker-FRC)
W83-03784

REMOVAL OF PHOSPHATES,

T. Stones.

Effluent and Water Treatment Journal, Vol 22, No 12, p 466-467, December, 1982. 6 Tab, 7 Ref.

Descriptors: *Phosphorous removal, *Wastewater treatment, *Phosphates, Sedimentation, Activated sludge process, Filtration.

Phosphate removal from sewage was investigated. A 12-hour detention period in a sedimentation tank reduced influent phosphate of 5.73 mgm per liter by 23%. This was not a result of biological activity. Sterilized and unsterilized sewage removed 31.8% and 31.9%, respectively, upon 18 hours settlement. Of the chemical coagulants tested at 400 mgm per liter, lime removed 88%; aluminum sulfate, 93.6%; and sulfuric acid, 26.7% of phosphate. Bilogical filtration removed 31.7% of phosphate; activated sludge treatment, 64-71%. (Cassar-FRC)
W83-03791

PILOT PLANT EXPERIMENTS ON THE PHYSICO-CHEMICAL TREATMENT OF MEAT PROCESSING EFFLUENTS,

Vizgazdalkodasi Tudomanyos Kutato Intezet, Budapest (Hungary).
I. Tookos.

Effluent and Water Treatment Journal, Vol 22, No 11, p 421-423, 425, 427, November, 1982. 2 Fig, 4 Tab, 7 Ref.

Descriptors: *Flotation, *Chemical precipitation, *Meat processing industry, *Wastewater treatment, Poultry, Sedimentation, Coagulation, Flocculation, Proteins, Lime, Physicohemical treatment.

Treatment of meat and poultry processing effluents was studied on the pilot plant scale. A dissolved air flotation process proved more efficient than a sedimentation process. For precipitating the protein, there were three suitable methods: flocculation around the isoelectric point of the proteins, coagulation with conventional chemicals such as aluminum hydroxide or ferric compounds, and lime precipitation at pH higher than 10 with addition of chemical coagulants. Choice of a treatment system depends on the size of the individual plant and on the intended use for the sludge (as animal feed or discarded). In general, flotation is recommended for larger plants and sedimentation for smaller plants. (Cassar-FRC).
W83-03792

COMPACT NITROGEN REMOVAL OPTIONS FOR LAKE COMO,

L. K. Wang.

Effluent and Water Treatment Journal, Vol 22, No 11, p 435, 437, November, 1982. 18 Ref.

Descriptors: *Nitrogen removal, *Denitrification, *Wastewater treatment, Ion exchange, Biological wastewater treatment, Reverse osmosis, Electrodialysis, Membrane processes, Rotating biological contactor, Lake Como, *Italy, Nitrification, Nitrates, Ammonia, Chlorination.

The compact wastewater treatment facilities for a resort (design population 8000) at Lake Como, Italy, are housed in an old stone boathouse. This paper reviews technically and economically feasible nitrogen removal methods for secondary dissolved air flotation effluent which require little additional space. These include biological nitrification by rotating biological contactor or denitrification filters, ion exchange, reverse osmosis, electrodialysis, breakpoint chlorination, and ammonia stripping. Processes less suitable for this compact facility are conventional coagulation, lime softening, and ferrous iron with a copper catalyst. (Cassar-FRC)
W83-03793

REMOVAL OF NITRILOTRIACETIC ACID DURING PRIMARY SEDIMENTATION AND ITS EFFECT ON METAL REMOVAL,

Imperial Coll. of Science and Technology, London (England). Public Health Engineering Lab.
A. C. Rossin, J. N. Lester, and R. Perry.

Environmental Pollution, Series B, Vol 4, No 4, p 315-330, 1982. 4 Fig, 4 Tab, 29 Ref.

Descriptors: *Nitrilotriacetic acid, *Detergents, *Metals, *Wastewater treatment, Water pollution effects, Fate of pollutants, Primary wastewater treatment, Sedimentation, Heavy metals, Suspended solids, Lead, Nickel, Zinc, Cadmium, Chromium, Copper.

The removal of nitrilotriacetic acid (NTA), a detergent builder, during primary sedimentation was studied in 2 pilot plants operated in parallel, one acting as a control. Hydraulic loadings were varied over the range representative of normal sewage treatment works operation. NTA was added at 15 or 30 mg per liter and was varied around these concentrations to simulate diurnal fluctuation. NTA removal was 16-40%, primarily by adsorption onto settleable solids. NTA removal was not correlated with suspended solids removal. No correlation between suspended solids removal and NTA removal was seen. The presence of NTA significantly reduced removals of Pb, Ni, and Zn, but had little effect on removals of Cd, Cr, and Cu. (Cassar-FRC)
W83-03813

ALTERNATIVE WASTEWATER MANAGEMENT STRATEGIES FOR RURAL AND URBAN-FRINGE COMMUNITIES,

Nova Scotia Dept. of Municipal Affairs, Halifax. Community Planning Div.
P. C. Campbell.

Canadian Journal of Civil Engineering, Vol 9, No 4, p 586-594, December, 1982. 16 Ref.

Descriptors: *Septic tanks, *Wastewater management, Management, *Wastewater treatment, Municipal wastewater, *Nova Scotia.

Rapid expansion of conventional municipal water and sewer systems into the rural areas of Nova Scotia during the 1960's has left many communities with systems which are expensive to operate and

maintain. In addition, many private and small community septic tank systems are malfunctioning. As a result, less costly alternative approaches for wastewater management are being considered. These include septic treatment and ground disposal or soil absorption. A 1978 report demonstrated that the alternative systems are feasible with proper site evaluation and professional management. A demonstration project at Port Maitland illustrated a system using 4 centralized cluster systems with community septic tanks and disposal in contour trenches. Thus far, savings in capital and operating costs have been 45-50% over a conventional system. The municipality is preparing to take over management of the system. (Cassar-FRC)
W83-03823

ACTIVATED CARBON FOR TREATMENT OF CADMIUM WASTEWATER,
Delaware Univ., Newark.
C. P. Huang, and P. K. Wirth.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 108, No EE6, p 1280-1299, December, 1982. 16 Fig, 4 Tab, 27 Ref.

Descriptors: *Wastewater treatment, *Adsorption, *Cadmium, *Activated carbon, *Industrial wastes, *Electroplating, Heavy metals, Adsorbents, Carbon, Regeneration, Hydrogen ion concentration, Economic aspects.

The removal of cadmium (Cd) by activated carbon from the wastewater effluents of industries using the Cd-electroplating process has received much attention in the 1970's. The adsorption characteristics of Cd(II) from Cd(II)-BF4 plating solution on granular or powdered activated carbons were examined in both batch mode and continuous flow experiments. The powdered activated carbon was bound to spheres using a suspension-polymerization procedure. Results showed that at all pH values, powdered activated carbons such as Nuchar SA and Nuchar SN exhibited greater Cd(II) removal capacity than the granular ones such as Darco HD3000 and Filtrasorb 400. The adsorption capacity of the aggregated carbons was 85-90% of the unbound ones. At pH 7, the rate of Cd(II) removal was found to be proportional to the Cd concentration, the carbon dose, and the available surface sites. Used activated carbons could be regenerated with strong acids such as HCl, HC104, and H2S04. Two treatment schemes, a completely mixed flow reactor activated carbon adsorption treatment system (with carbon regeneration) and a column reactor activated carbon adsorption system (with carbon regeneration) are proposed, along with economic analyses for comparison with other common treatment processes. (Geiger-FRC)
W83-03825

EFFECT OF POLYELECTROLYTES ON BIOFILM GROWTH,
Escuela Politecnica Nacional, Quito (Ecuador).
E. J. La Motta, R. F. Hickey, and J. F. Buydos.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 108, No EE6, p 1326-1341, December, 1982. 7 Fig, 48 Ref.

Descriptors: *Polymers, *Polyelectrolytes, *Biological wastewater treatment, *Biological membranes, *Literature review, *Wastewater treatment, Nitrification, Cations, Anaerobic conditions, Sewage bacteria, Reviews.

During nitrification and anaerobic carbon removal in wastewater treatment processes, biofilm attachment and growth may take several weeks or even months. The literature describing bacterial attachment and growth is reviewed. The effect of surface conditioners made from synthetic and naturally produced polymers on the rate of biofilm attachment and growth was investigated in batch experiments using the continuous flow rotating disk reactor with primary sewage as substrate. The rate of biofilm attachment and growth was accelerated by use of a cationic polymer precoat (American Cyanamid 2535, Percol 722 or Calgon WT 2640) on the surface of the media before the final biofilm is induced to grow. Precoating with naturally produced biopolymers enhanced biofilm growth of nitrifiers and substrate conversion even more effectively than precoating with synthetic cationic polymers. However, in full scale engineering applications, the extraction of biopolymers would be too impractical and expensive to warrant their use as a precoat. (Geiger-FRC)
W83-03826

ANAEROBIC DIGESTION OF WASTE ACTIVATED SLUDGE,
Cornell Univ., Ithaca, NY. Dept. of Environmental Engineering.
J. M. Gossett, and R. L. Belser.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 108, No EE6, p 1101-1120, December, 1982. 10 Fig, 2 Tab, 22 Ref.

Descriptors: *Mathematical models, Model studies, *Activated sludge process, *Anaerobic digestion, *Sludge digestion, Activated sludge, Biological treatment, *Wastewater treatment, Mathematical studies, Kinetics, Biodegradation.

The effect of solids retention time in the activated sludge process on the performance of anaerobic digesters fed the resulting waste sludges was evaluated in model studies. Activated sludge systems were operated over various solids retention times and the waste sludges were used as feed sources for batch and semicontinuous anaerobic digestion studies. Previously described models for aerobic biodegradability of activated sludges gave accurate predictions of ultimate anaerobic digestibility. However, traditional kinetic models of digestion overestimated actual performance with this substrate. An activated sludge anaerobic digestion model was formulated which incorporates a first-order rate mechanism for preliminary conversion of viable activated sludge biomass into available anaerobic substrate. A decrease in solids retention time causes an increase in sludge for digestion. However, these solids are more digestable, so that both the quantity of digested solids for ultimate disposal and the cost of digestion are virtually independent of the solids retention time. (Geiger-FRC)
W83-03827

CLARIFICATION FAILURE CONTROL STRATEGIES,
Clemson Univ., SC. Dept. of Environmental Systems Engineering.
T. M. Keinath, and V. D. Laquidara.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 108, No EE6, p 1121-1127, December, 1982. 8 Fig, 2 Tab, 1 Ref.

Descriptors: Process control, *Clarification, *Suspended solids, *Activated sludge process, *Mixed liquor solids, *Wastewater treatment, Activated sludge, Steady flow, Sludge thickening, Sludge, Solids, Aeration.

Two solids inventory control strategies for the prevention of clarification failure in the activated sludge process are proposed. The mechanisms of clarification failure are explained in terms of a clarification failure analysis diagram. Recycle rate control is shown to be effective for only a certain class of operational situations, usually where steady-state conditions prevail. It is not applicable to situations where an activated sludge system is experiencing severe hydraulic surges. Effective solids inventory control for all situations where clarifiers are overloaded with respect to both thickening and clarification can be achieved only through the step feed control strategy in which the location of the feed to the aeration basin is shifted downstream in a multiphase basin. (Geiger-FRC)
W83-03828

INNOVATIVE APPROACHES TO SEWAGE COLLECTION, TREATMENT, AND DISPOSAL: PRACTICES IN NORTHERN CANADA,
Alberta Univ., Edmonton. Dept. of Civil Engineering.
D. W. Smith, and V. Christensen.
Canadian Journal of Civil Engineering, Vol 9, No 4, p 653-662, December, 1982. 10 Fig, 11 Tab, 19 Ref.

Descriptors: *Cold regions, *Wastewater disposal, *Sewer systems, *Wastewater treatment, Wastewater management, Wastewater lagoons, Wastewater collection, *Canada, Pipes, Truck collection, Land disposal, Lagoons, Water conservation, Waste disposal, Lakes, Disinfection, Ozonation.

Wastewater management in northern Canada (Yukon and Northwest Territories) has undergone significant changes in the past 10 years. Among the innovations are use of butt-welded polyethylene pipe for sewer lines, individually insulated water and sewer lines between the mains and the household connection, and trucked collection of wastes. For undiluted wastes a system to macerate the collected plastic bags is under development. However, the method for capturing plastic fragments before effluent discharge has not yet been successful. Few innovations have been made in treating moderately diluted wastewater such as holding tank contents. Ponds and pits are most frequently used. Lagoons, frequently used to treat conventionally diluted wastewater, have been modified in three ways: lagoon with discharge to a swamp, lagoon with discharge to the land surface, and a chain of lakes. Dilute wastewater is usually treated by screening followed by discharge into lagoons. Some research is being done on rotating biological contactors and ozone treatment for this dilute effluent. For greywater disposal, a sand filter followed by disinfection has been suggested but is not yet widely used. A program to publicize methods for conserving potable water is expected to reduce consumption by 40-60%. (Cassar-FRC)
W83-03840

5E. Ultimate Disposal Of Wastes

INVESTIGATION OF THE SOLIDIFICATION OF WASTEWATER CONCENTRATES WITH INORGANIC BINDING AGENTS (UNTERSUCHUNGEN UBER DIE VERFESTIGUNG VON ABWASSERKONZENTRATEN MIT ANORGANISCHEN BINDEMITTELN),
Stuttgart Univ. (Germany, F.R.). Inst. fuer Siedlungswasserbau, Wasserguete- und Abfallwirtschaft.
R. Wagner.
Zeitschrift fuer Wasser und Abwasser Forschung, Vol 14, No 4, p 119-131, August, 1981. 6 Fig, 13 Tab, 29 Ref.

Descriptors: *Sludge disposal, *Cements, *Gypsum, *Leaching, *Solid wastes, Sludge thickening, Water pollution control, Wastewater disposal, Waste disposal, Federal Republic of Germany.

Certain mixtures of high-alumina cement and gypsum, supplemented as necessary with lime hydrate and added in amounts of 0.6 to 2.75 kg/liter, are capable of transforming liquid or sludge-type wastes into solid matter. The results of elution tests showed that some wastewater pollutants (different metal ions, organic substances) are contained in the solidified material in a readily leachable form, and others in a more strongly bound form. The solidification process results in a decrease in the mobility of the pollutants above and beyond a mere adsorption effect, depending on the setting and aging time. (Author's abstract)
W83-03505

LAND APPLICATION OF SEWAGE SLUDGE LANDFILL LEACHATE,
Rhode Island Univ., Kingston. Dept. of Plant and Soil Science.
W. R. Wright, and H. J. Brown.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-227389, Price codes: A02 in paper copy, A01 in microfiche. Water Resources Center Completion Report, Univ. of Rhode Island, Kingston, December 1982. 18 p, 10 Tab, 6 Ref. OWRT A-078-RI(1), 14-34-0001-2142.

Descriptors: *Heavy metals, Nitrogen, Groundwater pollution, *Leachates, *Sludge, Landfills, *Wastewater disposal, Septic sludge, Water pollution sources, Soil chemistry.

This investigation evaluated the feasibility of the 'living filter' concept as an alternative method of heavy metal leachate disposal to prevent contamination of groundwaters. Leachate collected from a simulated sewage sludge landfill was applied at rates of 0, 200, 400, and 600, Kg N/ha/yr to plots of rye grass (L. perenne) to evaluate the attenuation of contaminants. The concentrations of metals Cd, Cu, Fe, Ni, Pb, and Zn, as well as nitrogen content, were analyzed over a 5 month period in soil, soil-water lysimeter extracts, and grass samples before, during and after application of landfill leachate. Exchangeable nitrogen (NH4 + NO3 + NO2) concentrations in soil were significantly higher at the 600. Kg, KgN/ha/yr rate while significantly greater concentrations were retained within the surface 30 cms. Soil-water extracts were significantly higher at the 400 and 600 Kg N/ha/yr rate and also highest in the surface layers. The concentrations of metals in the soil and soil-water extracts remained generally unchanged statistically. Yields of rye grass did not differ significantly within the three rates of N application, but exchangeable nitrogen was highest at the 600 KgN/ha/yr rate. In general, heavy metal accumulation in the soil was not a problem but nitrogen contamination to ground-waters could be of legitimate concern when applying sewage sludge landfill leachate to a grass crop.
W83-03563

VARIABLES AFFECTING METAL REMOVAL FROM SLUDGE,
Ethyl Corp., Baton Rouge, LA.
D. J. Wozniak, and J. Y. C. Huang.
Journal of the Water Pollution Control Federation, Vol 54, No 12, p 1574-1580, December, 1982. 5 Fig, 1 Tab, 21 Ref.

Descriptors: *Wastewater treatment, *Metals, *Activated sludge process, Sludge, Sludge treatment, Acidity, Suspended solids.

The pertinent variables affecting the efficiency of acidification for the removal of the heavy metals cadmium, chromium, copper, lead, nickel, and zinc from wastewater treatment sludge solids were sought. Metal removals were found to be dependent on the pH, the solids concentrations, the specific type of metal, and the length of acidification time. Solubilization rates and ultimate removal efficiencies for all metals investigated increased with time and with decreasing pH and solids concentrations. For many cases, limitations in the extent of metal solubilization exist, depending on pH and solids concentrations. The orders of metal removal vary, depending on the pH. Of interest in the chromium and nickel removals were the large amounts of the metals removed immediately after acid addition. For both of these metals, the initial solubilization represented over half of the total metal able to be solubilized under the specific conditions, which might indicate that a significant portion of these metals existed as inorganic precipitates or as weakly chelated forms within or on the sludge solids. Acid usage in the metal solubilization process was dependent on the concentration of sludge solids, the desired pH value, and the length of time needed to maintain the pH. For most of th metals investigated a solids concentration of 1% may be optimal for metal removal and acid savings. (Baker-FRC)
W83-03581

ASSESSMENT OF HEAVY METALS AND PCBS AT SLUDGE APPLICATION SITES,
Canada Centre for Inland Waters, Burlington (Ontario).
M. D. Webber, H. D. Monteith, and D. G. M. Corneau.
Journal of the Water Pollution Control Federation, Vol 55, No 2, p 187-195, February, 1983. 2 Fig, 8 Tab, 15 Ref.

Descriptors: *Sludge disposal, Metals, *Land application, Fate of pollutants, Land disposal, *Polychlorinated biphenyls, *Heavy metals, *Ontario, Agriculture.

Heavy metals and polychlorinated biphenyls (PCB's) were assessed in soils and plant matter from 10 Ontario wastewater sludge land application sites. The sites were chosen to represent a variety of soil types, sludge applications from 1 to 21 years and 9 to 90 tons per ha total, and a variety of loadings of the different contaminants. In general, sludge treatment increased the total metal and PCB contents of soils. Largest increases in pollutant levels were found in soils with the greatest estimated sludge loadings. Mean pollutant levels in sludge treated soils (micrograms per g, air dry weight) were: Cd, 1.06; Zn, 190; Cu, 41.1; Ni, 27.2; Pb, 37.8; and PCB's, 0.142. Metals extractable by diethylenetriamine pentaacetic acid in the receiving soils were also higher in control soils and were well correlated with total metals. Except for Zn there were few significant effects of sludge treatment on crop composition (corn and oats). There was no apparent PCB uptake from contaminated soils. Most plant materials had metals and PCB levels within normal ranges, except for corn from the Stratford site, which contained excessive Mo levels. It is believed that application of sludge according to Ontario Sludge Utilization Guidelines is unlikely to cause deleterious uptake of heavy metals by field crops. (Cassar-FRC)
W83-03633

FINE-COAL-AIDED CENTRIFUGAL DEWATERING OF WASTE ACTIVATED SLUDGE,
Enviro Enterprises, Inc., Salt Lake City, UT.
O. E. Albertson, and M. Kopper.
Journal of the Water Pollution Control Federation, Vol 55, No 2, p 145-156, February, 1983. 8 Fig, 11 Tab, 13 Ref.

Descriptors: *Sludge solids, *Coal, *Dewatering, Sludge conditioning, Flocculation, Polyelectrolytes, Centrifugation, Sludge solids, Incineration, Filtration, Waste treatment, Wastewater disposal.

Adding fine coal to waste activated sludge, flocculating with polyelectrolytes, and centrifuging in a new type slow speed, co-current scroll centrifuge significantly reduced the moisture content of the resulting sludge cake. During about 80 full-scale tests optimum operating conditions were developed to yield a coal/sludge cake of 25-37% solids with addition of polymer and 0.1 to 0.3 kg coal per kg of sludge solids. Using polymers without coal addition achieved cake solids of 18-23% totol solids. Fuel savings for incineration ranged from 60 to 90%. Retrofitting existing vacuum filter furnace installations with co-current centrifuges using fine coal plus polymers could increase furnace capacities 30-100% and pay back retorfitting cost within about a year. (Cassar-FRC)
W83-03659

MAGNESIUM RECYCLING BY CARBONATION AND CENTRIFUGATION OF HIGH-LIME WASTEWATER SLUDGE,
Tahal Consulting Engineers Ltd., Tel-Aviv (Israel).
E. Idelovitch, and A. M. Wachs.
Journal of the Water Pollution Control Federation, Vol 55, No 2, p 136-144, February, 1983. 10 Fig, 5 Tab, 13 Ref.

Descriptors: *Magnesium compounds, *Dewatering, *Lime, Carbonates, Bicarbonates, Sludge conditioning, Oxidation ponds, Polyelectrolytes, Boron, Fate of pollutants, Heavy metals, Phosphorus, Organic matter, *Recycling, Waste treatment, Waste disposal.

High-lime treatment of secondary wastewater effluent or raw wastewater produces a sludge high in Mg(OH)2 and difficult to dewater. This paper describes a process to dissolve the Mg for recycling. This increases sludge cake dewatering capacity and solids content and reduces polyelectrolyte requirements. Effluents were obtained from wastewater oxidation ponds in the Dan Region, Israel. Carbon dioxide is bubbled through the sludge to reduce the pH to about 9 to form a mixture of magnesium carbonate and magnesium bicarbonate with a dissolution efficiency of 35-40%. Dissolved magnesium is recovered from the sludge solids by centrifugation with polyelectrolyte addition. The dissolved Mg is recycled directly to the lime treatment process, which required about 35-45 mg per liter total Mg. In this process neither Ca nor the undesirable materials (organics, phosphorus, or heavy metals) are dissolved to an appreciable extent. Although reduction of the pH to 8 improves efficiency to 50-60% and forms magnesium bicarbonate exclusively, it dissolves considerable boron, which is harmful to crops. (Cassar-FRC)
W83-03660

DEVELOPMENT OF A REGIONAL SLUDGE DEWATERING FACILITY USING PRESSURE FILTERS,
Black and Veatch, Denver, CO.
G. F. Shimp, C. P. Houck, and B. Baumgartner.
Journal of the Water Pollution Control Federation, Vol 55, No 2, p 130-135, February, 1983. 1 Fig, 5 Tab.

Descriptors: *Sludge disposal, *Dewatering, *Regional development, Sludge conditioning, Sludge solids, Summit County, Colorado, Filters, Waste treatment, Waste disposal.

A regional sludge handling and disposal facility for Summit County, Colorado, a ski area, started up in April 1981. Sludge is hauled by truck from 5 municipal treatment plants to the sludge handling plant, based on pressure filtration. Processed sludge is currently landfilled, but will be available for land reclamation and game lands fertilization when these beneficial uses develop. The user charges are based on a base fee, a gallonage charge, and a solids loading charge. (Cassar-FRC)
W83-03661

WATER QUALITY IN THE FIRTH OF FORTH,
Napier Coll., Edinburgh (Scotland). Dept. of Biological Sciences.
For primary bibliographic entry see Field 5D.
W83-03784

FILTRABILITY AND COMPRESSIBILITY OF SLUDGES, PART 1,
Nigeria Univ., Nsukka.
J. O. Ademiluyi, U. G. N. Anazodo, and N. Egbuniwe.
Effluent and Water Treatment Journal, Vol 22, No 11, p 428-431, November, 1982. 5 Fig, 2 Tab, 9 Ref.

Descriptors: *Filtration, *Compressibility, *Dewatering, Sludge, Sludge treatment, Sludge handling, Sludge disposal, Wastewater treatment.

An effort to experimentally determine the value of the exponent b in the basic equation used to describe the sludge filtration process at constant pressure was not conclusive. Buchner funnels of different sizes were used to determine the relationship between filtrate volume (V) and area (A). The exponent b, the slope of log V vs. log A, was calculated to be 0.91 + or - 0.02. Substituting the higher and lower values in the equation produced disparate values of specific resistance (R). Until the problem of obtaining a more precise value for the actual area of filtration can be solved, it is suggested that specific resistance of sludges can be calculated from: (1) Carman's equation, using the total area of the Buchner funnel as the total area, (2) the dimensional equation, using the filtration area measured as the effective area of the Buchner funnel, or (3) the partial dimensional equation, which produces the value of the exponent b. (Cassar-FRC)
W83-03790

LANDFILL MANAGEMENT AND LEACHATE QUALITY,
J. F. Rees.
Effluent and Water Treatment Journal, Vol 22, No 12, p 457, 459, 460, 462-463, December, 1982. 5 Fig, 2 Tab, 10 Ref.

Descriptors: *Landfills, *Leachates, *Waste dumps, Carboxylic acids, Domestic wastes, Solid wastes, Water quality control, Methane, Bacteria, Microbial degradation, Degradation, Chelation, Metals, Fate of pollutants.

Conditions favoring good quality of leachate (minimum total carboxylic acids) from domestic refuse landfills are the presence of water, a high degree of microbial activity, high pH, low oxidation/reduction potential, and rapid fermentation (generates sulfides and carbonates to precipitate heavy metals). Low refuse density (0.35 tons per cu m) produced aerobic decomposition similar to composting, with very little carboxylic acid leaching. Refuse at a density of 0.95 tons per cu m produced a leachate much higher in carboxylic acids than refuse placed at a density of 0.67 tons per cu m. Pulverized refuse produced higher carboxylic acid levels in leachates than crude refuse. Allowing liquids to rise through the landfill (by bumping or rising groundwater) as opposed to letting liquids percolate downwards improved conditions for methanogenesis. In establishing a new landfill, conditions for methane production may be enhanced by using low-density refuse (0.35 tons per cu m) for the base, mixing of wood and paper with domestic refuse, and adding water to the base of the landfill. (Cassar-FRC)
W83-03812

TOTAL ORGANIC HALOGEN (TOX) CONCENTRATIONS IN THE WEST LAFAYETTE WASTEWATER TREATMENT PLANT EFFLUENT AND THE WABASH RIVER,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
J. M. Bell, and R. D. Buesink.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-253310, Price codes: A08 in paper copy, A01 in microfiche. Technical Report No 160, August 1971. 143 p, 13 Fig, 45 Tab, 135 Ref, 1 Append. OWRT-A-063-IND(1).

Descriptors: *Halogens, *Organic compounds, *Wastewater treatment, Chlorination, Wabash River, West Lafayette, *Indiana, Chlorinated organic compounds, *Total organic halogens.

The magnitude of the chlorinated organic compounds was determined in the Wabash River and in the effluent at the West Lafayette Wastewater Treatment Plant (WLWTP). All samples were tested using an activated carbon adsorption procedure followed by pyrolysis with quantification via microcoulometric titration system. The mean upstream Total Organic Halogen(TOX) concentration was 10.7 mug/1. The mean downstream TOX concentration was 9.5 mug/1. The upstream TOX concentrations were not significantly different from season to season, nor were the upstream and downstream TOX concentrations. The unchlorinated WLWTP effluent mean TOX concentration was 30.0 mug/1 while the chlorinated effluent mean TOX was 66.7 mug/1. The portion of the chlorine demand associated with the TOX concentration was 1.41% in the WLWTP. A mass balance revealed that the increase in TOX, after complete mixing in the river would only be 2.33 mug/l, which would not be detectable. Field observations confirmed that the downstream TOX concentrations were not significantly different from the upstream concentrations. The impact on the Wabash River of chlorinated organics in the WLWTP effluent can be considered relatively minimal.
W83-03819

5F. Water Treatment and Quality Alteration

GROWTH OF THE MUNICIPAL WATER SYSTEM IN CIUDAD JUAREZ, MEXICO,
Texas Univ. at Austin. Dept. of Geological Sciences.
W. J. Lloyd.
Natural Rsources Journal, Vol 22 No 4, p 943-955, October, 1982. 4 Fig, 32 Ref.

Descriptors: *Juarez, *Water distribution, *Water supply development, *Costs, Water conveyance, Groundwater mining, Wells, Water supply, Water metering, *Mexico, Water shortage, Urban areas, Rio Grande, Water requirements, Cindad Juarez.

Current water resources and the water system of Ciudad Juarez (Mexico) are discussed, and implications for the future are considered. All city water is pumped from underground reserves of the Hueco Bolson aquifer, which underlines the city. Mexico's share of the Rio Grande water is totally committed for agriculture. Domestic water consumption averages 299.5 liters/capita/day. Water is distributed to households either through private water taps in homes or private courtyards or through public taps along the streets. Some water is also delivered in barrels or trucks. 90% of the population now have direct access to water. The city's population is expected to exceed 2,000,000 by the year 2000, which means the level of water service must also expand. The city has a goal of a production level of 360 liters/capita/, day with a direct service service target of 85%. Thus, the number of wells will be increased to 104 by the mid-1990s, which will give a well capacity of 5500 liters/sec. An increase in the use of water meters may be necessary to pay for the new wells an expanded distribution system. (Small-FRC)
W83-03502

BACTERIAL GROWTH ON ION EXCHANGE RESIN - INVESTIGATIONS WITH A STRONG CATIONIC EXCHANGER. PART 1: ATTACHMENT AND DISTRIBUTION OF BACTERIA: OPERATIONAL POSSIBILITIES OF SUPRESSING BACTERIAL GROWTH (BAKTERIENWACHSTUM AUF IONENAUSTAUSCHERHARZ-UNTERSUCHUNGEN AN EINEM STARK SAUREN KATIONEN-AUSTAUSCHER. TEIL 1: ANHAFTUNG UND VERTEILUNG DER BAKTERIEN; BETRIEBLICHE MOGLICHKEITEN DER WACHSTUMS-UNTERDRUCKUNG),
Stuttgart Univ. (Germany, F.R.). Inst. fuer Siedlungswasserbau, Wasserguete- und Abfallwirtschaft.
H-C. Flemming.
Zeitschrift fuer Wasser und Abwasser Forschung, Vol 14, No 4, p 132-139, August, 1981. 8 Fig, 8 Tab, 36 Ref.

Descriptors: *Ion exchange, *Resins, *Bacteria, *Growth rates, *Water treatment, Growth, Sodium chloride, Disinfection, Closed systems, Backwash, Monitoring, Cations, Federal Republic of Germany.

A review is presented of bacterial growth on ion exchange resins including the attachment and distribution of bacteria and methods to supress bacterial growth. Bacteria are not necessarily attached securely to the surfaces of an ion exchange resin. They can, for example, be easily washed off the strongly acidic cation exchanger Llewatit S 100. On this exchanger, the bacteria are distributed inhomogeneously in the resin bed in the form of 'nests'. The number of nests in the upper region of the ion exchange column is normally higher than the number in the lower region. Continuous operation or keeping the resin in the generation agent during off-periods are possible methods for suppressing bacteria growth. A 20% sodium chloride solution can suppress generation over a longer period of time. Insufficient methods which cannot replace disinfection of the resin include closed-loop operation, back-flushing, and regeneration. Ion exchange resin units must be subjected to routine bacterial monitoring in all cases where there are hygienic implications to their use. (Small-FRC)
W83-03507

ON THE METHODOLOGY OF DESIGN AND USE OF MONITORING AND CONTROL PROGRAMS FOR GROUNDWATER MANAGEMENT FACILITIES (ZUR METHODIK DES AUFBAUS UND DER NUTZUNG VON KONTROLL- UND STEUERUNGSPROGRAMMEN VON GRUNDWASSERFASSUNGSANLAGEN),
Technische Univ., Dresden (German D.R.). Bereich Hydrobiologie.
L. Luckner, and W. Nestler.
Wasserwirtschaft-Wassertechnik, Vol 32, No 7, p 219-223, July, 1982. 7 Fig, 1 Tab, 14 Ref. (No English Summary).

Descriptors: *Groundwater management, *Automation, *Computer programs, *Forecasting, *Water treatment facilities, Artificial recharge, Water distribution, Drinking water, Water demand, Water quality management, Water quality control, Water resources development, Monitoring, Monitoring and control programs, *German Democratic Republic, Mathematical equations.

Recommendations are made for automated monitoring and control systems for groundwater management facilities in the German Democratic Republic. These are necessary because more than 70% of the projected 3-4% yearly increase in water demand must be met by existing groundwater facilities. A unified total hardware and software suitable for all groundwater works should be developed. It should be capable of modification to fit each facility individually with different levels of control; it should be of modular design, be user-friendly, reliable, and use state-developed technology; it should be efficient in terms of manpower, dead time, stability/flexibility, costs, and adaptability; it should be capable of incremental incorporation of water quality considerations into all aspects of groundwater management; and it should make it possible for each facility to operate optimally within the total system. Programs with internal data processing are necessary for the control of artificial recharge facilities, particularly those with difficult-to-manage reservoir volumes (small time constants). A suggested system contains modules for input, command variable size (primarily the development of a drinking-water demand projection), generation of water distribution variables, analysis of present and projected situations, simulation of volume and quality dynamics, data storage and updating, and output. Examples are given of East German facilities at which some or all of these modules are used. (Gish-FRC)
W83-03522

THE MID-TERM EXTENSION PROGRAM FOR THE BODENSEE-WASSERVERSORGUNG (DER MITTELFRISTIGE AUSBAU DER BODENSEE-WASSERVERSORGUNG),
Bodensee-Wasserversorgung, Stuttgart (Germany, F.R.).
G. Naber.
Wasserwirtschaft, Vol 71, No 3, p 61-68, March, 1981. 9 Fig, 15 Ref. English summary.

Descriptors: *Water supply development, *Water resources development, *Water management, *Water conveyance, *Drinking water, Resources development, Potential water supply, Resources managment, Treatment facilities, Pipelines, *Federal Republic of Germany.

Following the rapid development of the Bodensee-Wasserversorgung (BWV), these was a consolidation phase during the nineteen-seventies. Under the so-called Mid-term Extension Program, considerable funds were invested in order to increase the reliability of supply and to improve the existing facilities. This program included the following projects: extension of the pumping facilities and treatment plants at Sipplingen, extension of the pipe network, and creation of additional storage capacity in the main centers of consumption. Due to its sound technical and economical basis, the BWV, the largest and most modern long distance water supply system in Germany, is now in a position to extend its own supply area as well as supplying Rheital, taking advantage of the Rheintal groundwater. (Author's abstract)
W83-03523

METHODOLOGY FOR DETERMINING THE PRESENCE AND ORIGIN OF ORGANIC MICROPOLLUTANTS,
Compagnie Generale des Eaux, Paris (France).
A. Guiraud, and J. Larnicol.
Water Science and Technology, Voi 14, No 12, p 127-142, 1982. 17 Fig, 12 Ref.

Descriptors: *Water treatment, *Organic compounds, Chromatography, Mass spectrometry, Oise River, Source of pollutants, Fate of pollutants, River basins, *France, *Pollutant identification.

An approach is described for the determination of organic micropollutants in the Oise River. The objectives of the approach are to locate the origin of possible micropollutants in the Oise water which may cause problems during treatment, distribution or consumption of the drinking water produced at the Mery-sur-Oise plant. Treatment at this plant combines the full range of existing processes, both physicochemical and biological. The conventional method of searching for organic micropollutants consists of carrying out a series of analysis in a medium to identify a certain number of undesirable substances and following their development in the stream. The existence of a drinking water production process detracts from the interest in testing for a number of micropollutants, since they are removed at various stages of the treatment process. Nevertheless, the protection of chemical and biological reactors requires that certain micropollutants be eliminated before the beginning of the treatment sequence. The analytical method used is gas or liquid chromatography; where identification is essential, a combination of mass spectrometry and liquid chromatography is used. The notion of a chromatogram or mass spectra bank is essential. The assumption underlying the method's validity is that the discharge likely to contain in large part the substances creating problems is that which usually contains them in small part. There is good indication to believe that this method can improve the identification and above all the elimination of the sources of micropollutants for the modern treatment of surface water intended for the production of drinking water. (Baker-FRC)
W83-03548

THE ELIMINATION OF MINERAL MICROPOLLUTANTS,
Compagnie Intercommunale Bruxelloise des Eaux (Belgium).
For primary bibliographic entry see Field 5D.
W83-03556

REMOVAL OF RADON FROM WATER USING GRANULAR ACTIVATED CARBON ADSORPTION,
Maine Univ. at Orono. Dept. of Civil Engineering.
J. D. Lowry.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-227397, Price codes: A03 in paper copy, A01 in microfiche. Land and Water Resources Center Completion Report, Univ. of Maine, Orono, June 1983. 31 p, 10 Fig, 1 Tab. OWRT A-057-ME(2), 14-34-0001-2121.

Descriptors: *Activated carbon, Adsorption, *Radioactivity, Radioisotopes, *Water treament, *Radon.

A concise summary is presented of the current knowledge on radon removal using granular activated carbon (GAC) treatment. The technical information is based upon laboratory and field research and it is presented in a question-and-answer format designed to provide information to persons considering a method to remove radon from a household groundwater supply. The questions addressed range in scope from basic ones like 'What is Radon.' to more complex ones associated with the buildup of radon daughters and gamma activity within the GAC bed. Other pertinent topics discussed and explained include: 1) type of GAC to use, 2) required capacity of GAC unit, 3) shielding considerations for GAC units, 4) effective life of a bed, 5) backwash requirements for GAC units, and 6) cost of GAC treatment. Research results show that a GAC unit is more cost effective than spray or diffused aeration. A typical 2.5 cu. ft. unit is capable of greater than 95% removal and will cost less than $10/year to operate and maintain. Initial costs ranges from about $450 to $800 depending upon capacity.
W83-03564

MONITORING WATER QUALITY PARAMETERS FROM MUNICIPAL WATER INTAKES,
Stroh Brewery Co., Detroit, MI.
J. J. Kubus, and D. A. Egloff.
Journal of the Water Pollution Control Federation, Vol 54, No 12, p 1592-1598, December, 1982. 4 Tab, 15 Ref.

Descriptors: *Water quality, *Monitoring, *Water treatment facilities, Drinking water, Municipal water supply, Statistical analysis, Lakes, *Lake Erie, *Ohio, *Regression analysis.

Water quality changes due to passage through municipal water intake systems were assessed in light of whether any changes were similar for different treatment plants and for different water quality parameters, and whether any of the observed changes were sufficiently constant to permit a statistically reliable estimation of lake values from plant values. Using regression analysis, water quality was monitored at each of three intakes on the Ohio shore of Lake Erie on four dates over a 12 month period. Significant regression equations were determined for 14 varibles, including temperature, conductivity, dissolved oxygen, alkalinity, nitrogen, phosphorus, silica, sodium, chloride, suspended solids, turbidity, and chlorophyll. Only rarely did plant values equal lake values. Significant increases or decreases occurred in the values of all parameters during passage of the water through the pipe at one or more of the intake sites. If water intakes are to be used to collect water quality data, regression equations for each parameter should be developed to account for changes in water quality introduced by the pumping system. (Baker-FRC)
W83-03568

THE EFFECT OF STRESS ON ORGANISMS IN THE DISTRIBUTION SYSTEM,
Delaware Univ., Newark. School of Life and Health Sciences.
For primary bibliographic entry see Field 5A.
W83-03602

THE REACTIONS OF CHLORINE DISINFECTANT WITH ORGANICS ADSORBED ON GRANULAR ACTIVATED CARBON,
Florida Water Resources Research Center, Gainesville.
J. J. McCreary, K. R. Batsel, and J. R. Rivera.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-236166, Price codes: A05 in paper copy, A01 in microfiche. Publication No 70, June 1983. 82 p, 32 Fig, 23 Tab, 32 Ref, 1 Append. OWRT A-048-FLA(1), 14-34-0001-2110.

Descriptors: *Activated carbon, *Chlorine, *Organic compounds, Mutagenicity, *Water treatment, Disinfection, Adsorption, Humic acids, Fulvic acids.

The reactions of aqueous free chlorine with two organic molecules were examined before and after adsorption on granular activated carbon. The molecules were both typical of subunits of naturally-occuring humic and fulvic acids. Reactions were conducted at chlorine/carbon ratios and at carbon column flowrates typical of those encountered in water treatment practice. It was observed that carbon catalyzed the hydroxylation of the aromatic ring in all reactions, even when chlorine was not present in the influent to the column. It was also observed that large molecular weight products could form, presumably via a free-radical mechanism at the carbon surface. The products of all reactions were determined by capillary GC/MS and in some cases, high resolution GC/MS was employed for additional structural information. Reaction of one organic at a higher pH produced similar products to those found at neutral pH. This work was then extended to the clorination of a fulvic acid water sample on activated carbon. The carbon at the influent end of the column contained compounds that were mutagenic in the Ames test, and had innumerable phthalates and fatty acid methyl esters.
W83-03624

CHLORAMINES - AN ANSWER TO THE TRIHALOMETHANE PROBLEM,
Delta Chemicals, Inc., Searsport, ME.
M. A. Dullea.
Journal of the New England Water Works Association, Vol 96, No 4, p 361-368, December, 1982. 2 Fig.

Descriptors: *Chloramines, *Trihalomethanes, Water quality control, Water pollution sources, Ammonium sulfate, Chlorine, Organic matter, Acidity, Temperature effects, *Water treatment.

The recent EPA mandated limits on chloroform and other trihalomethanes (THM) in drinking water are discussed. Many utilities have no difficulty in meeting this THM limit, others may have a problem only sporadically, and some may have a persistent problem. Key factors affecting THM concentration in final drinking water are: organic precursors naturally occurring in water such as humus and fulvic substances, amount of free chlorine coming in contact with the organic matter, presence of other halogen ions, contact time, temperature, and pH. Free chlorine in contact with natural organic precursors is at the heart of the problem. Utilities chlorinating surface water have the biggest problem. The simplest solution is alternate chemical disinfection. Of the alternatives, chloramines will play a significant role. A simple, efficient, non-hazardous route to chloramines is through the use of Food Chemical Codex grade ammonium sulfate. (Baker-FRC)
W83-03625

HOW MUCH PREVENTIVE MAINTENANCE IS TOO MUCH,
For primary bibliographic entry see Field 5D.
W83-03638

USING WATER DISTRIBUTION SYSTEM MODELS,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
For primary bibliographic entry see Field 8B.
W83-03641

THE HISTORY OF WASTE DETECTION IN SEVERN-TRENT WATER AUTHORITY'S DERWENT DIVISION,
J. W. West.
Journal of the Institution of Water Engineers and Scientists, Vol 36, No 6, p 405-414, December, 1982. 2 Fig, 1 Tab.

Descriptors: *Leakage, *Water metering, Water distribution, History, Water loss, Derwent, *England, *Water treatment.

Detection of waste in the Derwent Division, Severn-Trent Water Authority, prior to 1975 consisted of handling direct complaints of leaks, district metering, and minimum night lines. The emphasis from 1975 to 1978 shifted to the minimum night line approach combined with district metering. In 1978 the policy was revised to include installation of waste water meters throughout the entire division. Unaccounted for water in 1982 was about 1/5 of daily consumption, slightly less than in previous years. (Cassar-FRC)
W83-03654

A SYSTEMATIC STUDY TO REDUCE TRIHALOMETHANE PRECURSORS IN LITTLE ROCK DRINKING WATER BY COMBINED ALUM COAGULATION/POWDERED ACTIVATED CARBON TREATMENT,
Arkansas Univ. at Little Rock. Dept. of Chemistry.
A. U. Shaikh.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-246389, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Center Publication No 101, University of Arkansas, Fayetteville, June 1983. 45 p, 10 Fig, 3 Tab, 30 Ref. OWRT A-057-ARK(1), 14-34-0001-0104.

Descriptors: *Powdered activated carbon, *Trihalomethanes, Chloroform, Bromoform, Bromodichloromethane, Dibromochloromethane, *THM precursors, Humic acid, *Direct aqueous injection, Solvent extraction, Gas chromatography, *Alum coagulation, Drinking water, *Arkansas, Little Rock, Water treatment.

Studies have been conducted to evaluate powdered activated carbon (PAC) as an agent for controlling trihalomethanes in drinking water. Laboratory studies indicate that PAC is highly efficient in removing free trihalomethanes in water within a few hours. The removal efficiency of humic acid, a known THM precursor, by PAC is considerably less. However, longer treatment time can remove the precursors quite significantly. Humic substances in surface water samples can also be removed by PAC.
W83-03683

AN INVESTIGATION OF THE CHEMISTRY OF DEGRADATION OF PESTICIDES AND OTHER SERIOUS ORGANIC CONTAMINANTS IN DRINKING WATER FOR APPLICATION TO DOMESTIC AND COMMUNITY WATER SUPPLIES,
New York State Coll. of Human Ecology, Ithaca. Dept. of Design and Environmental Analysis.
A. T. Lemley, and G. E. Janauer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-249649, Price codes: A02 in paper copy, A01 in microfiche. Center for Environmental Research Completion Report, July 1983. 3 p. OWRT A-093-NY(1), 14-34-0001-0134.

Descriptors: *Aldicarb, Groundwater, *Ion exchange, *Pesticides, *Carbamates, Analytical methods, Community water supplies, Domestic wells, *New York, Long Island, Suffolk County, Leaching, Drinking water, *Wastewater treatment, Pollutant identification.

The systemic pesticide, Temik, has leached to ground water in Suffolk County on eastern Long Island. Its active ingredient, Aldicarb, leaches through certain soils into ground water after systemic application; this has created serious problems with drinking water on Long Island and in other parts of the country. A novel approach to treating carbamate contaminated drinking water has been investigated and found to be successful on the laboratory scale. It was reported earlier that acid catalyzed hydrolysis and nucleophilic cleavage of organophosphate pesticides are effectively achieved in situ on ion exchange beds charged with protons or hydroxyl ions. Similar experiments with Aldicarb and its environmental oxidation products, both batch equilibrium studies and mini columns, have demonstrated virtually complete detoxification of part per million to part per billion level solutions. Base and acid hydrolysis degradation rates for Aldicarb/metabolites in solution under a variety of conditions have also been determined. A systematic correlation of batch contact data with column and fundamental solution data is currently under investigation. Analytical methods for detection and quantification of the Aldicarb species have also been developed and refined. HPLC using a UV detector, a reverse phase column, and methanol/water as the mobile phase has been combined with simple preconcentration procedures to give a rapid and reliable 'flow through' technique which does not require bulk extraction or cleanup of water samples. A new gas chromatographic method has been perfected for quantification of solutions at the ppb level.
W83-03725

TOTAL WATER MANAGEMENT--THE DENVER STORY,
CH2M/Hill, Denver, CO. Water Engineering Dept.
For primary bibliographic entry see Field 5D.
W83-03746

MODERN TREATMENT IN THE MIDDLE EAST.
Water and Waste Treatment, Vol 25, No 3, p 34, 36, March, 1982.

Descriptors: *Desalination, *Arid regions, *Saline water, *Water treatment, *Membrane processes, Dissolved solids, Wastewater treatment, Middle East, Egypt, Libya.

Water treatment for the Middle East is customized to fit wide variations in population density, industrial activity, water supply, and total dissolved solids content. For example, high Fe levels in a Libyan village water supply were treated with iron removal, filtration, and disinfection, instead of the customary desalination techniques. Membrane processes such as electrodialysis and reverse osmosis are frequently used for saline water treatment, replacing distillation with its high capital and energy costs. Package sewage plants are increasing in popularity for towns, hotels, and construction camps. (Cassar-FRC)
W83-03764

SOURCES OF TRIHALOMETHANES AND OTHER C1 AND C2 HALO-ORGANICS IN POTABLE WATER,
J. Prest.
Effluent and Water Treatment Journal, Vol 22, No 12, p 449-452, 454-456, December, 1982. 1 Fig, 5 Tab, 12 Ref.

Descriptors: *Chlorination, *Organic compounds, *Water treatment, Trihalomethanes, *Chlorinated hydrocarbons, Chloroform, Hurleston Treatment Plant, *England, Water pollution sources, Fate of pollutants.

Trihalomethanes (THM) were determined in treated water from the Hurleston water treatment works in England over a 7-month period. The major halogenated organics were chloroform and bromodichloromethane, with smaller amounts of dibromochloromethane and on one occasion only, bromoform. Concentrations of THMs varied greatly with season (29 micrograms per liter in February and 50-64 micrograms per liter in summer), source of raw water (higher in raw water containing sewage effluent), and mode of water treatment (30 micrograms per liter with prechlorination and 8 micrograms per liter with postchlorination and activated carbon treatment). The rate of THM production was slow, taking up to 12 hours to reach a maximum concentration. Organochlorine contaminants in the liquid chlorine used to treat water were 32-74 mg per kg chloroform and lesser amounts of other compounds. The source of bromine in the finished water was raw water, not impurities in the chlorine added for treatment. (Cassar-FRC)
W83-03799

EFFECT OF COPPER ON NITROGEN FIXATION AND GROWTH OF BLUE-GREEN ALGAE IN NATURAL PLANKTON ASSOCIATIONS,
California Univ., Davis. Div. of Environmental Studies.
W. A. Wurtsbaugh, and A. J. Horne.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 39, No 12, p 1636-1641, December, 1982. 4 Fig, 1 Tab, 32 Ref.

Descriptors: *Algicides, *Copper, *Toxicity, Water treatment, Aphanizomenon flos-aquae, Algae, Diatoms, *Cyanophyta, *Nitrogen fixation, Nutrients, Phytoplankton, Lakes, Growth rates, Eutrophied lakes, Clear Lake, *California, Chelation.

Bioassays to assess copper toxicity were performed during a bloom of Aphanizomenon flos-aquae in eutrophic Clear Lake, California, during six 5-7 day periods in April and May 1973. Inhibition of nitrogen fixation, carbon fixation, and pigment accumulation increased linearly between 10 and 30 micrograms Cu per liter. Increasing the Cu concentrations to 75 micrograms per liter did not greatly increase toxicity to algae. At very low Cu levels (2 micrograms per liter) algal growth was stimulated. Copper did not have an inhibitory effect on nitrogen fixation without a comparable or greater effect on carbon fixation or chlorophyll a. Pennate diatoms growing with the Aphanizomenon were less sensitive to Cu; growth was not inhibited at concentrations up to 20 Cu micrograms per liter. Before adding algicide short-term bioassays should be conducted to determine the effects of a lake's chelation and sediment detoxification properties, since the minimum effective dose can vary widely between lakes and at different times of the year. For Clear Lake the effective dose was determined to be 30-75 micrograms Cu per liter. (Cassar-FRC)
W83-03837

5G. Water Quality Control

PRINCIPLES FOR TRANSBOUNDARY GROUNDWATER POLLUTION CONTROL,
L. A. Teclaff.
Natural Resources Journal, Vol 22, No 4, p 1065-1079, October, 1982. 47 Ref.

Descriptors: *Water pollution control, *Groundwater, *Legal aspects, Monitoring, Water pollution sources, Surface water, International law.

The effective regulation of transboundary groundwater pollution lags behind the evolution of rules for transfrontier surface water pollution. The sources of groundwater pollution are frequently more numerous and more widely distributed than in the case of surface water contamination and, while many of them arise from water-related activities, others have nothing whatever to do with water use per se. Groundwaters store contamination, and the process is often irreversible. Monitoring is more difficult than for surface waters. The first need in transboundary pollution control is to develop rules for the collection and dissemination of information. Once an adequate data base has been established for a transboundary groundwater resource, the next task is classification. This classification provides a basis for the establishment of standards and the adoption of management practices, recharge zone protection, land use regulation and other measures for groundwater protection. For the fullest protection of a groundwater resource some land use regulation is essential, especially in the critical recharge area of an aquifer. Although awareness of the dangeer of groundwater pollution is increasing, the binding effect of remedial rules may be indefinitely delayed if left to the slow process of creating customary international law. Regional and local entities can play a useful role as adjuncts to a commission of wider areal jurisdiction. (Baker-FRC)
W83-03501

EVOLUTION OF NITRATE CONCENTRATIONS IN GROUNDWATER IN THE MIDDLE VAUD REGION (SWITZERLAND) (EVOLUTION DES CONCENTRATIONS EN NITRATES DES EAUX SOUTERRAINES DU MOYEN-PAYS VAUDOIS),
Inspectorat Cantonnal des Eaux, Lausanne (Switzerland).
For primary bibliographic entry see Field 5B.
W83-03508

SANITARY MONITORING OF SEAWATER IN BATHING AREAS OF FRANCE (SURVEILLANCE SANITAIRE DES EAUX DE BAIGNADE EN MER EN FRANCE),
Ministere de la Sante et de la Securite Sociale, Paris (France)
D. Tricard.
Progress in Water Technology, Vol 12, No 4, p 543-552, 1980. 1 Tab.

Descriptors: *Coliforms, *Coastal waters, *Swimming, *Monitoring, *Water quality, Public health, Bacteria, Water pollution, Feces, Streptococcus, Seasonal variation, Coastal zone management, *Mediterranean Sea, *France.

The French Ministry of Health set up a program in 1972 to monitor water quality in public areas along the Mediterranean Sea. During the high use season water samples are taken once a week. The samples are analyzed for: total coliforms, fecal coliforms, and fecal streptococci. If water quality is not satisfactory, measures taken include improvement of

sewage installations and closing of the contaminated beach areas. All water quality results are analyzed at the close of the summer season. This analysis indicates what areas are subject to pollution and many cause changes in the sanitary policies of nearby towns. During the 1978 summer season, 515 sample points were followed up using 500 samples. Data collected are presented. (Small-FRC)
W83-03515

RESULTS OF LAKE CLEANUP IN THE ORDER-HAVEL CATCHMENT AREAS (ERGEBNISSE DER SEESANIERUNG AUS DEM EINZUGSGEBIET DER WWD ORDER-HAVEL),
Wasserwirtschaftsdirektion Oder Havel, Potsdam (German D.R.).
H. Schmidt, and E. Rohde.
Wasserwirtschaft-Wassertechnik, Vol 32, No 8, p 280-282, 1982. 2 Fig, 5 Ref.

Descriptors: Water management, *Planning, Pollution, Seawater, *Water quality control, Metropolitan water management, Eutrophication, Longterm planning, Algae, Water depth, Water treatment, Ecosystems, Ecological effects, *Federal Republic of Germany, Oder-Havel catchment.

Experiences with cleaning up lake waters in the Order-Havel district are recounted. Eutrophication, evidenced by increased concentrations of aquatic plants and algae, is the greatest problem of the water bodies in this district. From 1976 to 1980, 11 bodies of water were cleaned up, and plans exist to clean at least 16 others. In shallow takes dredging was the main method employed; this increased the navigability, removed obstructions to flow, and improved land values, fisheries and transport. (Titus-FRC)
W83-03516

ADMINISTRATIVE COORDINATION IN THE IMPLEMENTATION OF AGRICULTURAL NONPOINT POLLUTION CONTROLS,
Illinois Univ. at Urbana-Champaign. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6E.
W83-03559

USE OF FERRUGINOUS GROUNDWATERS TO AUGMENT STREAMFLOW,
H. A. C. Montgomery.
Journal of the Institution of Water Engineers and Scientists, Vol 36, No 5, p 343-351, September, 1982. 3 Tab, 10 Ref.

Descriptors: *Groundwater, Water supply development, *Iron compounds, Water quality, Streamflow, Rivers, Boreholes, Catchments, Legal aspects, Reservoirs, *Low flow augmentation, Water quality management, *Flow augmentation.

The water quality implications of low flow augmentation at sites where the groundwater contains iron are described. In a typical low-flow augmentation scheme several small boreholes are used in the upper catchment, each with a low yield in the range 1-5 Ml/d, giving in aggragate a valuable increase in flow at a downstream abstraction point. In some circumstances the increased flow is beneficial to fish and other aquatic life. Normally, augmentation would only be used for periods of a few weeks or months, and by no means every year. As the water is only pumped when needed, operating costs are minimized and full use is made of naturally available river flows. Local investigations revealed certain minor streams on the Isle of Wight, containing on the order of 3-6 mg iron/liter and severely affected by unsightly ferruginous deposits and iron bacteria. Low-flow augmentation by ferruginous groundwaters is likely to have adverse effects on fish spawning grounds, benthic invertebrates, stream flora, and the appearance of streams. Although the legal procedures are tedious, such discharges should be controlled by normal consent procedures. For discharges to streams classified under the National Water Council (NWC) system, maximum permissibile concentrations of iron can be calculated for each proposed augmentation discharge based on the river quality standards (RQS) downstream. Relevant factors in the calculations are the concentrations of iron in the discharge and the stream, the ratio of the flow rate of the discharge to the appropriate low flow of the stream, and in some cases the rate of deposition of iron, which should be found by experiment. Control is recommended such that the iron does not exceed 2 mg/liter in Class 1A streams and 3 mg/liter in Class 1B streams. Individual limits should be set for unclassified streams, depending on the legitimate uses. (Baker-FRC)
W83-03577

A METHOD TO COMPUTE RIVER HEATING - APPLICATION TO THE MANAGEMENT OF THERMAL LOADINGS TO THE RHINE RIVER (UNE METHODE DE CALCUL DE L'ECHAUFFEMENT DES RIVIERES - APPLICATION A LA GESTION DES REJETS THEMIQUES AU RHIN),
Ecole Nationale Superieure des Mines de Paris, Fontainebleau (France). Centre d'Information Geologique.
M. Poulin, and P. Hubert.
Journal of Hydrology, Vol 55, No 1/4, p 195-211, 1982. 8 Fig, 2 Tab, 7 Ref.

Descriptors: *Thermal pollution, *Heated water, Mathematical studies, Rivers, *Mathematical models, Waste heat, Thermal powerplants, Powerplants, Cooling water, Industrial water, Flow rate, Water temperature, Wind velocity, Rhine River, *Federal Republic of Germany.

The newly introduced concept, especially for administrative purposes, of increases in river temperature due to thermal discharges produced a need for convenient computational methods. A method is presented which computes the river mean excess temperature with a daily time-step for several monitoring stations. The only data used are the values of thermal loadings, river flow rate, water temperature, and wind speed. In a case study, the error was less than 20%. The method was used to design a management model for a set of thermal power stations cooled by a river which is subject to temperatures in excess of standards. This model was then applied to the Rhine River. (Author's abstract)
W83-03584

AN INSTITUTIONAL PERSPECTIVE ON THE USE OF NATURAL RESOURCES AND THE IRRIGATION AND NITRATE CONTAMINATION PROBLEM,
Wisconsin Univ.-Madison. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6B.
W83-03587

ENGINEERING AND LEGAL RAMIFICATIONS OF GROUNDWATER CONTAMINATION - A CASE STUDY,
Dufresne-Henry, Inc., Concord, MA.
G. R. Allan.
Journal of the New England Water Works Association, Vol 96, No 4, p 329-336, December, 1982. 2 Fig.

Descriptors: *Groundwater pollution, *Legal aspects, *Water pollution control, Water pollution sources, Water supply, Case studies, Groveland, *Massachusetts, Trichloroethylene, Solvents, Organic compounds, Interceptor wells.

A case study is presented of how one town in Massachusetts reacted to the loss of its entire water supply due to contamination by trichloroethylene (TCE). To meet its water supply demands, Groveland received emergency water through existing connections with Haverhill and Georgetown. The town received a $157,000 grant from HUD under the Imminent Threat to Public Health and Safety Program to construct another well and pumping station. A Special Town Meeting was held to investigate the source, direction and possible treatment of the water supply. The field phase of the suggested program consisted of installing 2.5 inch test wells in strategic locations to determine groundwater levels and to sample for contamination. A seismic survey was also used to determine depth to bedrock. A total of 37 water samples was taken and tested for 12 volatile organic compounds. Two separate pollution sources were identified, and in each case a specific polluter was identified. To restore the acquifer to conditions where one or both wells could be reactivated, the use of interceptor wells was proposed as the first step. A deep well turbine pump would be used to discharge the water to a man-made lagoon, where artificial aeration would be introduced. From the lagoon the water would be discharged to a nearby brook. The basis for this program is the volatile nature of the organic contaminants. It is suggested that such interceptor wells are an inexpensive restoration technique. (Baker-FRC)
W83-03626

SOURCE PROTECTION - AN OUNCE OF PREVENTION,
Dufresne-Henry, Inc., North Springfield, VT. Solid Waste Dept.
J. A. Dohrman.
Journal of the New England Water Works Association, Vol 96, No 4, p 322-328, December, 1982. 2 Fig.

Descriptors: *Groundwater management, *Protection, *Aquifers, *Vermont, *Massachusetts, Planning, Management, Drinking water, Water quality, Case studies.

An aquifer assessment report is provided which presents the groundwork from which a source protection plan can be developed for a particular town. Both of the towns considered in this report are at present formulating local zoning changes and implementing the other recommendations as contained in this report. Any source protection plan must be preceded by a definition of the source recharge area and an evaluation of existing and proposed land use. An aquifer assessment study contains two basic components, a hydrogeologic study to define the geologic setting and recharge limits, and a land use evaluation of existing and proposed land use activities. The first assessment is for Middlebury, Vermont, where the initial concern was a crop dusting operation at the airport. The hydrogeologic study included a two-phase subsurface evaluation, with goals aimed at defining the origin of the sand and gravel making up the aquifer, determining the approximate extent of the upper clay layers, and locating the recharge area boundary in the direction of the airport. The second assessment was made for the town of Sunderland, Massachusetts. The aquifer was a classic delta formation of highly permeable sand and gravel and had been fairly well documented in several previous geology reports. The town was primarily concerned about several proposed developments within the delta area. (Baker-FRC)
W83-03627

GROUNDWATER PROTECTION ON THE LOCAL LEVEL: INTEGRATING THE FRAGMENTS OF REGULATION,
J. K. Chanoux.
Journal of the New England Water Works Association, Vol 96, No 4, p 310-321, December, 1982.

Descriptors: *Groundwater management, *Legal aspects, Groundwater contamination, Drinking water supplies, Concord, *Massachusetts, Water quality, Groundwater, Watershed protection, Case studies.

The development and implementation of the land use regulatory phase of a ground water protection program on the municipal level are described. The particular approach which a community adopts for the protection of groundwater should reflect that community's goals, needs and resource characteristics. Alternative approaches should be presented and considered. The extent of municipal power to regulate land use for the protection of groundwater is considered with special emphasis on police power, reasonableness of objectives regarding groundwater protection, reasonableness of means, and enabling legislation. Management op-

tions include traditional zoning, performance zoning, subdivision regulations, health regulations, wetland protection, erosion and sedimentation, and general groundwater protection law. The need for local regulatory programs to protect groundwater is derived from the essentially public character of this resource. The right of a municipality to interfere in the private use of property in order to promote the public interest is grounded in its police powers. Groundwater protection may be legislated on the local level through various means. A comprehensive implementation program to protect groundwater resources in Concord, Massachusetts, is described in depth. (Baker-FRC)
W83-03628

RESERVOIR EUTROPHICATION AND MANAGEMENT,
Lycott Environmental Research, Inc., Southbridge, MA.
L. Lyman.
Journal of the New England Water Works Association, Vol 96, No 4, p 353-360, December, 1982.

Descriptors: *Water quality control, *Reservoirs, *Eutrophication, Algal growth, Organic material, Lakes, Ponds, Drinking water, Water quality.

Whenever a new reservoir is constructed, it will go through a period of stabilization. Problems encountered in management of a reservoir include the fact that in many instances the water must continue to be used for public consumption while still trying to manage a long-term eutrophic body of water. It is recommended that any water department or district that has a reservoir associated with its supply should evaluate its reservoir in relationship to the eutrophic scale. Once the rate of eutrophication has been established for the reservoir in question, the next step is to begin long term corrective measures. Most such measured deal with land use, e.g., the restriction of roadway and highway construction and use, together with development of residential, agricultural, and industrial lands. With accelerated eutrophication, various water quality problems arise. These can include periodic algae blooms, reduction of transparency and degradation of color, increased bacterial growth, and increased sodium content. Aeration is a technique which has been employed for the past 10-12 years by various water departments to manage the production of algae and control hydrogen sulfide, produced at the bottom or in the hypolimnic region of deep reservoirs. Dredging should be the last resort for any body of water in that it disrupts the chemical, biological, and fisheries systems more extensively than dredging of the sediments. Other control measures include physical sealing of vegetative growth, weed harvesting, and chemical management. (Baker-FRC)
W83-03629

MANAGING THE RISK AND LIABILITY OF TOXIC CONTAMINATION OF WATER SUPPLY,
Geomet Technologies, Inc., Rockville, MD.
For primary bibliographic entry see Field 6F.
W83-03630

HERE COMES THE WATER BUBBLE--MAYBE,
K. C. Flynn.
Journal of the Water Pollution Control Federation, Vol 55, No 2, p 116-118, February, 1983.

Descriptors: *Standards, *Effluent limitations, *Water pollution control, *Bubble concept, Air pollution, Regulations, Pulp and paper industry, Fox River, *Wisconsin, Industrial wastewater, Wastewater disposal, Pollution load.

The bubble concept, sometimes applied in air pollution control, has not been widely applied to water pollution control. However, this approach is being successfully used to regulate discharges from a complex of 14 pulp and paper mills crowded within 20 miles of the Fox River, Wisconsin. Factors which make the bubble approach work here are the concentration of many mills into a small area and the nature of the stream, which is small and subject to seasonal low flows. During low flow conditions some pulp mills shut down some operations to preserve water quality of the stream. The only true national bubble in water pollution control is in the steel industry. It allows plants with multiple wastewater discharge outfalls to exceed the effluent limit for a pollutant at one outlet if there is an offsetting reduction at another point. A similar policy, although not a true bubble policy, in the petroleum industry and pulp and paper industry allows a single limitation per plant. It is not expected that the bubble approach can be economically applied to any other industries at this time, partly because industries in a given watershed are often diversified. Problems in applying the bubble concept to water include difficulties in the legal definition of pollutant sources, complicated standards, the wider latitude states have in enforcing water standards as compared with air standards, problems in measuring nonpoint source pollution, inadequate areawide planning, and greater concentration of pollutants in water than in air. (Cassar-FRC)
W83-03634

CHANGING THE CLEAN WATER ACT: REFLECTIONS ON THE LONG-TERM.
For primary bibliographic entry see Field 6E.
W83-03635

INTEGRATION OF MANAGEMENT METHODS WITH THE LIFE CYCLE AND ECOLOGY OF THE FILAMENTOUS ALGA, PITHOPHORA,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
For primary bibliographic entry see Field 4A.
W83-03680

THE ESTIMATION AND APPLICATION OF THE DEMAND FOR DISCHARGE WITHIN THE CONTEXT OF WATER QUALITY MANAGEMENT SYSTEMS,
Clemson Univ., SC. Dept. of Economics.
For primary bibliographic entry see Field 6F.
W83-03701

ENVIRONMENTAL QUALITY STANDARDS--NEW PROBLEMS FOR THE ANALYST,
For primary bibliographic entry see Field 5A.
W83-03798

CACO3 NEUTRALIZATION OF ACIDIFIED SURFACE WATERS,
Syracuse Univ., NY. Dept. of Civil Engineering.
C. T. Driscoll, J. R. White, G. C. Schafran, and J. D. Rendall.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 108, No EE6, p 1128-1145, December, 1982. 10 Fig, 2 Tab, 34 Ref.

Descriptors: *Acidic water, *Water quality control, *Neutralization, *Lake sediments, *Detritus, Theoretical analysis, Acid streams, Acidity, Chemical properties, Lime, Organic matter, Model studies, Calcium carbonate, *New York, Big Moose Lake.

Field studies were carried out to compute the theoretical base requirements for the neutralization of an acidified aquatic system, examine the feasibility of using calcium carbonate as a neutralizing agent, and assess the water quality changes associated with calcium carbonate. Theoretical calculations based on aqueous base neutralizing capacity underestimated the calcium carbonate dose required to achieve lake neutralization (pH 6.5) in Big Moose Lake in the Adirondacks of New York for one year. Results indicated that lake sediments greatly influence base dose requirements, especially if much organic detritus is present. Neutralization with calcium carbonate altered water column pH, calcium, acid neutralizing capacity, dissolved inorganic carbon, dissolved organic carbon, free fluoride, aluminum, manganese, zinc, and copper levels. Chemical equilibrium models aided in predicting changes in aqueous aluminum chemistry. However, limestone barriers do not appear to be a feasible means for neutralization of lake acidity. The deposition (fouling) of hydrolyzing metals and organic detritus within the barrier represents a significant operational problem. (Geiger-FRC)
W83-03834

MATHEMATICAL MODEL FOR MANAGEMENT OF WATER QUALITY IN RIVERS: APPLICATION TO THE YAMASKA RIVER (MODELE MATHEMATIQUE DE GESTION DE LA QUALITE DE L'EAU EN RIVIERE: APPLICATION A LA RIVIERE YAMASKA),
Institut National de la Recherche Scientifique, Sainte-Foy (Quebec).
M. Pineau, J. P. Villeneuve, and P. G. C. Campbell.
Canadian Journal of Civil Engineering, Vol 9, No 4, p 573-585, December, 1982. 3 Fig, 11 Tab, 31 Ref.

Descriptors: *Pollution load, *Phosphorus, *Water quality standards, Model studies, Mathematical models, Yamaska River, *Quebec, Wastewater treatment, Nonpoint pollution sources, Agricultural runoff, Nutrients, Water quality control.

A simple mathematical model was developed for identifying the optimal strategies for controlling nutrient loadings, particularly phosphorus, to a river basin. The objective of the optimization was to maintain phosphorus concentrations at 0.06 mg per liter or less at minimum costs. The model was applied to a study of the 4911 sq km Yamaska River basin, Quebec, where nutrient loadings from municipal, industrial, and agricultural sources are excessive. Allowable pollutant loads were calculated for each of 7 towns to achieve the specified goals for phosphorus levels in the river. (Cassar-FRC)
W83-03839

THE COMPREHENSIVE WATER QUALITY MANAGEMENT PROGRAM FOR THE LAGUNA DE BAY IN THE PHILIPPINES,
Laguna Lake Development Authority, Manila (Philippines). Environmental Protection Div.
J. D. Centeno, and B. L. Adan.
Water Supply and Management, Vol 6, No 6, p 557-565, 1982. 4 Fig, 2 Tab, 3 Ref.

Descriptors: *Water quality control, *Developing countries, *Philippines, Laguna de Bay, Water management, Water pollution control, Model studies, Planning, Financial aspects.

The Laguna de Bay is the largest freshwater lake in Southeast Asia; the uses of its resources include irrigation, fishery and public water supply. The comprehensive water quality management program and strategies adopted by the Laguna Lake Development Authority for proper abatement of water pollution in the Laguna Lake are outlined. A review of the main sources affecting the water quality of the lake provided guidance in the formulation of the water quality management program. The focus of the program is to control various sources of water pollution and minimize or prevent spread of diseases, thus improving the health and economy of the area. Major pollution sources were from the human population, agricultural and industrial activities, and in a small proportion from fallout within the basin and the recurring Pasig River backflow which brings saline water into the lake. The program calls for application of administrative measures, including preparation and enforcement of rules and regulations to implement the program, monitoring of lake and tributary river water quality for assessment of effectiveness of pollution control measures, implementation of pollution reduction measures directed to the control of the various pollution sources, continuation of researchers on the limiting factors of eutrophication, implementation of demonstration projects and the operationalization of the ecological model as a tool for decision making. (Baker-FRC)
W83-03843

STRATEGIES FOR WATER QUALITY MANAGEMENT IN THE CHAO PHRAYA RIVER IN THAILAND,
Asian Inst. of Tech., Bangkok (Thailand).
B. N. Lohani, and M. S. Mya.
Water Supply and Management, Vol 6, No 6, p 521-543, 1982. 11 Fig, 3 Tab, 5 Ref.

Descriptors: *Water quality control, *Planning, Developing countries, *Thailand, Water management, Water pollution control, Water quality, Reservoir releases, Reservoir operation, Flow augmentation.

A finite element substance dispersion model is formulated and applied for determining effluent standards and degree of waste water treatment levels so as to maintain BOD5 and DO levels in the Chao Phraya river, as stated in the Stream Standards. The mangement policies studied are specifying degree of waste water treatment, setting effluent standards and determining reservoir operating policies. Six quality policies were studied with the help of the model to examine the appropriate policy that will provide a desired level of DO and BOD in the river. Different effluent standards for BOD5 were studied to determine the most appropriate standard. It was noted that setting effluent BOD5 at a maximum of 60 mg/l with minimum flow rate of 100 cubic m/sec would be a suitable control measure. Flow augmentation was also studied to determine the additional flow of water to be released from the upstream reservoir at the Chao Phraya dam to the extent that the water quality in the river will be maintained at the desired level for 95% of the time. It was concluded that a release of 20 cubic m/sec of additional flow in excess of the present level of reservoir operation was needed to achieve the stream standards. (Baker-FRC)
W83-03845

RECENT DEVELOPMENTS ON STOCHASTIC PROGRAMMING MODEL FOR WATER QUALITY MANAGEMENT,
Asian Inst. of Tech., Bangkok (Thailand).
B. N. Lohani, and A. R. Saleemi.
Water Supply and Management, Vol 6,No 6, p 511-520, 1982. 3 Fig, 1 Tab, 6 Ref.

Descriptors: *Model studies, *Water quality control, Rivers, Developing countries, Stochastic process, Mathematical studies, Dissolved oxygen, Water pollution control.

A stochastic programming model for regional water quality management in rivers has been developed which incorporates all the water quality parameters as stochastic entities and thus provides a more realistic formulation than earlier models. For the formulation of a model for water quality management under stochastic environment, a stream on which there are n wastewater discharge sources is considered. The river is divided into n reaches, each reach being between two waste water discharge points. The treatment system at any discharge source includes waste flow rate and the initial BOD content in the waste water, which are both random parameters and can be represented by a known probability density function. The stream is considered as an integral part of the system, and BOD removal required at each discharge point depends on the assimilative capacity of the stream. Flows in stream reaches are considered as random variables, and thus they are known only with a certain probability of occurrence. Further, the deoxygenation and reaeration coefficients in the river are also considered as stochastic variables and hence occur with a certain probability. The stochastic programming model as presented was applied to the Hsintein River in Taiwan. Findings demonstrate this model to be superior to the earlier model of Lohani and Thanh. (Baker-FRC)
W83-03846

MODELLING A RIVER WATER QUALITY SYSTEM: A CASE STUDY OF TANSHUI RIVER IN TAIWAN,
Asian Inst. of Tech., Bangkok (Thailand).
B. N. Lohani, and F. C. Yang.
Water Supply and Management, Vol 6, No 6, p 487-509, 1982. 16 Fig, 8 Tab, 8 Ref.

Descriptors: *Model studies, *Water quality, *Rivers, Water pollution control, *Taiwan, Tanshui River, Biochemical oxygen demand, Dissolved oxygen.

A mathematical model for simulating BOD and DO in the Tanshui River Basin in Taiwan is presented. An optimization model was also formulated to examine appropriate water pollution control policies for the Tanshui River Basin. Results gained from the DO-BOD model were then compared with the observed values. Optimal waste water loadings to maintain a desired DO value in the Tanshui River were also specified. While close correlation was found between model findings and experimental results in most cases, slight discrepancies occurred at the river mouth due to the noninclusion in the model of some parameters to quantify the effect of tidal conditions. Through use of the model study DO standards for different reaches of the basin have been recommended. Waste discharges along the river can be adjusted through the application of management stragtegies such as waste water treatment, artificial reaeration, waste withholding, and others, so as to maintain a specified standard in a river using the approach of the optimization model developed. Water quality in the upstream and midstream reaches for all the area is still above the recommended standards. However, for downstream reaches the observed DO levels for Hsintien, Keelung, and Tanshui Rivers are below the standard levels. Basinwide pollution control strategies are needed to help improve the Tanshui River quality. (Baker-FRC)
W83-03847

ESTABLISHING WATER QUALITY OBJECTIVES AND EMISSION TARGETS IN RIVERS,
Asian Inst. of Tech., Bangkok (Thailand). Div. of Environmental Engineering.
B. N. Lohani.
Water Supply and Management, Vol 6, No 6, p 469-485, 1982. 1 Fig, 3 Tab, 14 Ref.

Descriptors: *Water quality control, *Water management, *Developing countries, Tropical Regions, *Asia, Planning, Water pollution control, Management, Decision making.

Essentials of water quality objectives and emission targets are outlined, and the rational water quality objectives are examined for several water uses for tropical countries, particularly the developing countries in Asia. Different management approaches are available for establishing water quality objectives, each with its own peculiar advantages and disadvantages depending on the area of study. However, the final goal of each method is the protection of natural water resources for their contemplated best usage. The establishment of water quality objectives and emission targets provides a more rational mechanism for achieving water quality at the desired level for the controlling use at minimum cost to an Asian country. It provides for flexibility in the adoption of methods for pollution control and abatement while at the same time placing the primary emphasis where it should be, on the receiving stream. Use of this approach requires a thorough knowledge of stream conditions and uses, which can be obtained only through exhaustive and time consuming studies. This indicates a strong, well staffed, and adequately financed water pollution control agency which is so closely associated with local problems as to permit adjustments in the classifications and objectives in keeping with changing stream conditions and water requirements. (Baker-FRC)
W83-03848

WATER QUALITY MANAGEMENT IN ASIA: BASIC ISSUES AND PRIORITIES,
Asian Inst. of Tech., Bangkok (Thailand).
B. N. Lohani.
Water Supply and Management, Vol 6, No 6, p 465-468, 1982.

Descriptors: *Water quality, *Developing countries, Planning, Water management, Monitoring, Cost analysis, Financial aspects, Water quality control, Water demand, *Asia.

In the majority of developing countries water pollution is perhaps a first priority issue, followed by solid waste and air pollution issues. Water quality management is often described as an organized effort to maintain or improve the ambient water quality against the waste water loads such that the beneficial use of water is not adversely affected by exercising a suitable control. Four major questions are presented: assessment of the water quality, assessment of water quality criteria, assessment of water quality impacts, and assessment of strategies for control. Assessment of water quality calls for a monitoring program with a great number of sampling stations and high frequency. A further factor of concern is the number of parameters to be measured which would adequately describe the water quality. Water quality criteria are often related to water use and are determined based on the nature of use quality relationships. Assessment of strategy control must consider a number of technological alternatives of water quality control at a time, take advantage of economies of scale, and find administratively more efficient methods. Water quality management forms one of the important objectives in the management of overall environmental quality, at least for some time, in the case of developing countries. (Baker-FRC)
W83-03849

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

GENERATING ALTERNATIVE SOLUTIONS FOR DYNAMIC PROGRAMMING MODELS OF WATER RESOURCES PROBLEMS,
Illinois Univ. at Urbana-Champaign. Dept. of Landscape Architecture, Urban, and Regional Planning.
L. D. Hopkins, E. D. Brill, Jr., and B. Wong.
Water Resources Research, Vol 18, No 4, p 782-790, August, 1982. 6 Fig, 2 Tab, 11 Ref.

Descriptors: *Flood plain management, *Alternative planning, *Dynamic programming, Land use, Model studies, Hickory Creek watershed, *Illinois, Planning, Water management, Weighted difference method.

The MGA (Modeling to Generate Alternatives) technique was proposed as a method for improving the application of optimum-seeking models. The intent of MGA is to generate sets of alternatives that are as different from each other as possible but are feasible given the physical structure of the system of concern and good with respect to target values for well-understood objectives. The approach will permit the decision maker to bring to bear his implicit knowledge of the problem, which could not be incorporated into the model. Three dynamic programming methods which differ in the procedure for identifying different alternatives are considered: adapting the kth best policy method based on a difference constraint, generalizing the preceding method by treating difference and the known objective as two components to be weighted, and searching a modified traceback for solutions of maximum difference. The second approach apparently has operational and conceptual advantages. The application of the weighted difference dynamic programming algorithm to the generation of alternatives was illustrated on the basis of a floodplain management model for the Hickory Creek Watershed in Illinois. In the Model, the watershed is divided into subbasins, each of which is associated with a reach of the stream. Possible land uses are defined with respect to hydrologic characteristics and economic rent. A dynamic programming algorithm can then be used to find the assignment of land uses to subbasins that maximizes economic rent to land for the entire watershed, while accounting for flood damages. Five alternative land use patterns were generated, giving economic rents within 2.4-7.7% of the original solution, and presenting a range of policy options for the decision maker. (Cassar-FRC)
W83-03580

A RIVER BASIN NETWORK MODEL FOR CONJUNCTIVE USE OF SURFACE AND GROUNDWATER: PROGRAM CONSIM,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
J. W. Labadie, S. Phamwon, and R. C. Lazaro.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-235291, Price codes: A07 in paper copy, A01 in microfiche. Colorado Water Resources Research Institute Completion Report No 125, Colorado State University, Fort Collins, June 1983. 134 p, 30 Fig, 6 Tab, 40 Ref. OWRT B-201-COLO(5), 14-34-0001-9061.

Descriptors: *River basins, *Simulation, *Optimization, Groundwater, *Conjunctive use, *Reservoir operation, *Computer programs, Model studies, Program CONSIM.

A generalized planning model has been constructed which simulates the dynamics of a complex river basin system. This model uses a network approach which is capable of modeling systems with a large-scale and complex water storage, transport, and distribution morphology. The model, called Program CONSIM, is also capable of considering stream-aquifer interaction, including the effects of pumping and artificial recharge on a monthly or weekly basis. Potential evaporation is computed directly in the model by the Blaney-Criddle method, but other methods can be selected by the user and input as demands in the model. Complex institutional factors such as formal water rights and informal exchange agreements can also be considered. The model as designed can be used for locating and sizing new facilities (e.g., reservoirs), impacts of transfer of water rights, incorporating new demands for energy development, instream uses, transbasin diversions, conjunctive use of surface and groundwater, and contingency planning for potential drought periods. The computer model has been especially designed to be interactive and conversational for ease of use by planners and managers.
W83-03596

STATED FINANCING POLICIES OF GOVERNMENT AGENCIES AND THE EXPERIENCE OF RURAL WATER SUPPLY SYSTEMS,
Cornell Univ. Agricultural Experiment Station, Ithaca, NY. Dept. of Agricultural Economics.
R. Vaidya, and D. J. Allee.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-235481, Price codes: A04 in paper copy, A01 in microfiche. Center for Environmental Research Completion Report, Ithaca, NY, July 1983. 49 p, 13 Tab, 9 Ref. OWRT-A-094-NY(1), 14-34-0001-1134.

Descriptors: *Water supply, *Community development, *Rural development, Public finance, Construction industry, Regression analysis, Government finance, Water policy.

A national data base of 800 water systems was used to match the stated policies of various public funding agencies (Farmers' Home Administration, Economic Development Administration, Housing and Urban Development) to the experience of their customers. The sample was representative of all rural water users in the nation. Regression analysis was used to match the experience of local communities with the stated policies. The results for the FHA serve as an example and are important because they have been the largest provider of public funds to systems serving rural people. For example, the stated policies of FMHA is to award grants or loans up to a fixed percentage of project cost; the results show that how much a water system gets does depend on how much it needs. The division of assistance between loans and grants varies with number of connections--the more connections, the larger share funded by loans. This is a direct result of interaction between the FHA policies known as the '1% rule' and the differences in income by size of community. The stated policy is to give priority to nonprofit systems with no stated difference between public and private. The results indicated that public systems have acquired larger grants but private nonprofit systems have been favored in terms of total numbers.
W83-03606

6B. Evaluation Process

DREDGED SEDIMENT FOR AGRICULTURE: LAKE PARADISE, MATTOON, ILLINOIS,
Illinois Univ. at Urbana-Champaign. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 3F.
W83-03558

AN INSTITUTIONAL PERSPECTIVE ON THE USE OF NATURAL RESOURCES AND THE IRRIGATION AND NITRATE CONTAMINATION PROBLEM,
Wisconsin Univ.-Madison. Dept. of Agricultural Economics.
D. W. Bromley, and R. C. Griffin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-235218, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Center Publications No WIS WRC 83-06, Univ. of Wisconsin, Madison, 1983. 49 p, 2 Fig, 1 Tab, 78 Ref. OWRT A-085-WIS(1), 14-34-0001-0153.

Descriptors: *Agricultural runoff, *Economic aspects, *Irrigation, *Natural resources, *Nonpoint pollution sources, Agricultural chemicals, Beneficial use, *Nitrates, Policy making, *Wisconsin, Central Sands area.

Cognizance of the nonpoint nature of many forms of agricultural pollution renders traditional pollution policies depend on the ability to identify the individual externality contributions of each economic agent. This fact has clouded the search for economically efficient programs for confronting instances of agricultural pollution and may have led to the institution of policies without sufficient attention to economic consequences. Discussions are provided of the consequences not including relationships or models performing as nonpoint production functions in economic analyses of agricultural runoff. It was noted that the Universal Soil Loss Equation has been used to obtain simultaneous economic and environmental modeling, but some deficencies in this type of analysis are still present. Present policy for agricultural runoff focuses on the concept of 'best management policies,' but several failures of this policy have been isolated. A second section of this report deals with fundamental economic questions of natural resources use, namely, who controls the institutions that allocate natural resources, who receives the benefits from particular use patterns and who is exposed to the costs arising from the use of natural resources. The third portion of the report is a layperson's discussion of the impacts of irrigation on nitrate contamination problem. The site of the study is the Central Sands area of Wisconsin. An outline is provided of the options of policymakers for solving this problem together with a discussion of the ramifications of each option.
W83-03587

ANALYSIS OF CRITICAL WATER PROBLEMS IN THE NORTHEASTERN UNITED STATES TO DETERMINE ESSENTIAL RESEARCH REQUIREMENTS,
Rhode Island Univ., Kingston. Water Resources Center.
D. W. Urish.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-235267, Price codes: A05 in paper copy, A01 in microfiche. Technical Report No 15, June 1983. 96 p, 6 Append. OWRT B-061-RI(5), 14-31-0001-3953.

Descriptors: *Research needs, *Research priorities, Wastewater managment, Flood damage, River basin development, Acid mine water, Sewage disposal, Northeast U.S., New England, *Water Research Institutes.

This project was a research planning endeavor and was regional in scope involving 15 Water Resources Centers or Institutes. The following objectives were pursued: 1. To develop an effective procedure for identifying research needs as they relate to critical water resource problems in the Northeast Region. 2. To seek participation by a broad spectrum of individuals and institutions in the Northeastern States confronted with water resource problems in order to assign priorities to these problems. 3. To facilitate the transfer of knowledge between the universities and public decision makers on the basis of collaboration and thus to lay the groundwork for effective technology transfer. 4. To make optimum use of available research funds through multiple university research cooperation. Six workshop conferences were held: Specific areas covered in workshops were: recycling urban wastewater on land, procedures for water research proposal review, river management needs, non-structural alternatives in flood damage abatement, acid mine water, and on-site treatment of domestic wastes. The published proceedings of these workshops identify critical research needs and provide guidance in research program development for both state and regional interests.
W83-03592

EVALUATION OF ALTERNATIVE PROCEDURES FOR REVIEW OF WATER RESOURCES RESEARCH PROPOSALS,
Massachusetts Univ., Amherst. Water Resources Research Center.
For primary bibliographic entry see Field 9D.
W83-03600

RIVER MANAGEMENT RESEARCH NEEDS,
Connecticut Univ., Storrs. Inst. of Water Resources.
V. E. Scottron.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-235333, Price codes: A06 in paper copy, A01 in microfiche. In: Proceedings, Workshop, University of Connecticut, March 11-12, 1976. Storrs, 15 p, 18 Ref. OWRT B-061-RI(6), 14-31-0001-3953.

Descriptors: *Research needs, *Research priorities, *Reservoir management, River Basins, River flow, River regulations, River systems.

River management research needs were discussed in detail at a series of workshops held at the University of Connecticut on March 11 and 12, 1976. There were 51 participants from the various states in Northeastern United States. There were three basic workshops covering the following topics: Case studies in River Modeling, Distinction Between Research and Management, Locational Needs for Research Institutions, Transferability of Research Data Between River Systems, and Effectiveness of Regional Collaborations. The following conclusions developed from workshop discussions: (1) The overlapping jurisdictions of regulatory bodies clearly offer a researchable area for the political scientist, (2) There exists a serious need for agencies to cooperate in the selection of data to make it more significant, (3) There is a need for a regional institution with explicit responsibility for encouragement and management of river-related research.
W83-03601

ECONOMIC RESEARCH NEEDS RELEVANT TO IMPROVED DRINKING WATER QUALITY,
Resources for the Future, Inc., Washington, DC.
C. S. Russell.
Journal of the American Water Works Association, Vol 75, No 1, p 6-9, January, 1983. 12 Ref.

Descriptors: *Economic evaluation, *Cost-benefit analysis, *Public health, *Drinking water, *Policy making, Management planning, Econometrics, Cost analysis, Water quality, Decision making, Water policy, Potable water, Economic aspects, Water management.

In estimating the economic benefits of alternative public policies to ensure drinking water quality, the policy must be translated into levels of quality and total quantities of contaminants experienced by consumers (policy-to-dose), the levels of alternative tap water quality must be translated into effects on health, household appliances and aesthet-

ics (dose-response), and the predicted or measured effects must be valued in dollar terms to be compared with the costs of a given policy (response-valuation). The valuation of health is examined in terms of morbidity, mortality, aesthetic effects, and acute and chronic disease. There is an inadequate database covering the effects of water quality on human illness due to the lack of location-specific air quality measures, occupational exposure differentials, diet and smoking indicators, historic measures of variables, complications raised by systematic migration patterns, and uncertainty about the mechanism that translates exposure into disease. A special subcommittee of the Environmental Protection Agency has recommended that the dose-response area should receive the most attention during the next decade if substantial progress is to be made in dealing with questions of benefits. (Geiger-FRC)
W83-03637

RESEARCH NEEDS FOR WATER SUPPLY COST ESTIMATING,
Environmental Protection Agency, Cincinnati, OH. Drinking Water Research Div.
R. M. Clark.
Journal of the American Water Works Association, Vol 75, No 1, p 10-13, January, 1983. 69 Ref.

Descriptors: *Water management, *Water costs, *Decision making, *Future planning, *Research priorities, *Financing, Costs, Total costs, Cost analysis, Management planning, Prediction, Project planning.

There is a need for standard and consistent costing procedures in the management of water supply systems to evaluate project costs, compare expected costs of alternative measures, provide data needed to ascertain the economic burden of an abatement process on a specific plant or industry, predict pollution control costs, and gauge the cost-benefits of pollution control programs on society. The major research needs for water supply costing can be categorized as unit process cost estimating, water delivery cost, total systems management, and system financing. A special Environmental Protection Agency subcommittee has identified seven categories for possible research regarding unit process cost estimating, two major areas of research connected with water delivery costs, seven areas of research needed to supplement system financing. It is hoped that the identification of these specific research needs will aid the profession in establishing priorities for future research. (Geiger-FRC)
W83-03648

WATER AND ENERGY CONSERVATION IN IRRIGATED AGRICULTURE: AN ARID AREA TECHNOLOGICAL AND ECONOMIC CASE STUDY,
Arizona Univ., Tucson.
For primary bibliographic entry see Field 3F.
W83-03773

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

INQUIRY INTO TAX GAINS FOR MEMBERS OF PARTNERSHIPS (STEUERLICHE GEWINNERMITTLUNG BEI PARTNERWERKEN),
Nordostschweizerische Kraftwerke A.G., Baden.
F. J. Harder.
Wasser, Energie, Luft, Vol 73, No 3, p 51-52, March, 1981. 1 Fig. (No English Summary).

Descriptors: *Hydroelectric plants, *Taxes, *Cost sharing, *Economic aspects, *Regional development, Resources development, Construction costs, Operating costs, Total costs, Legal aspects, Cost allocation, *Switzerland, Hydroelectric power, Electric power costs, Electric power industry, Powerplants, Electric powerplants.

The accusation is addressed that the mountain cantons of Switzerland are being exploited by power station partnerships in that the partnerships are taking hydroelectric power from the cantons while giving too little in return. The cantons of Graubunden and Wallis, in particular, want to impose a tax upon the electric companies. It is pointed out that the hydroelectric power stations could not have been built without funds from the central plateau cantons, and that this arrangement has been mutually economically beneficial. During the construction period, industry and transportation in the area in which the powerplant is being built are stimulated. The power station partnership pays water taxes and duties during the 80 years that the power station is under its franchise (after this time it reverts to the canton) and must also donate a certain amount of energy to the canton and pay for new roads. The partnership is not formed for the sake of profit but to ensure adequate energy supplies at reasonable costs. It usually takes the form of a joint stock company in which the individual powerplant gives its energy to the partnership, which in return takes responsibility for the total costs of the powerplant. Thus risks are shared among the partners and breakdowns or other crisis situations in one station resulting in energy production losses can be covered by the other partners. Cantons and parishes examine the partnership contracts and ratify them; it must therefore be assumed that they have reviewed the sections concerning taxzes and have approved them. It is legally and economically impossible that hidden profit gains are being realized by power stations outside the production areas because of the joint-stock form of the partnership. Furthermore, energy produced at a reasonable cost benefits the consumer rather than tha partners. If the proposed tax is imposed, high energy costs will result. (Gish-FRC)
W83-03530

WATER PRICING RESEARCH NEEDS,
West Virginia Univ., Morgantown. Dept. of Economics.
P. C. Mann.
Journal of the American Water Works Association, Vol 75, No 1, p 24-27, January, 1983. 37 Ref.

Descriptors: *Pricing, *Research priorities, *Water costs, *User charges, *Reviews, Prices, Economic aspects, Water use, Costs, Future planning, Water management.

Traditionally, water rates are based on cost of service, with average prices for users and unavoidable price discrimination. While there is adequate information about rate structure alternatives, time-differentiated and conservational pricing and spatially differentiated or zonal pricing, there are gaps in knowledge on the actual effects of zonal or differentiated pricing, methodologies for applying alternative pricing methods, classification of consumer groups, and the effect of different kinds of water charges currently used by water utilities. Research is needed on the effects of innovative pricing, and the integration of cost of service with marginal cost pricing. Research is also needed on the causes of underpricing of water service, its short- and long-term effects, and alternative solutions to this problem. (Geiger-FRC)
W83-03649

EFFICIENT PRICING AND FINANCING OF URBAN WATER: THE ROLE OF DEVELOPMENT CHARGES,
Hawaii Univ. at Manoa, Honolulu. Water Resources Research Center.
R. Pollock, and J. E. T. Moncur.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-246447, Price codes: A04 in paper copy, A01 in microfiche. Technical Memorandum Report No 69, June 1983. 53 p, 5 Fig, 5 Tab, 21 Ref.

Descriptors: *Prices, *Water costs, Development charges, Urban areas, Simulation models, Marginal costs, *Urban water, Hawaii, Washington, Oregon, California, Colorado.

Conventional methods of evaluating and designing urban water prices are deficient in several important respects. Urban water is underpriced substantially, due to undercosting which in turn results from failure to adjust accounting data for inflation; to recognize imputed costs, such as interest on equity capital; and to fully provide for rising real costs of source supply. Further, water users often cross-subsidize one another due to uniform 'postage stamp' pricing. This report uses data covering twelve Western U.S. urban water utilities to describe this undercosting and underpricing; describes a 'first-best' pricing paradigm based on real marginal cost; outlines a role and basis for calculating, development charges; and simulates their effects with a discrete non-stochastic simulation model.
W83-03689

THE FEASIBILITY OF ENGINEERING-ECONOMIC-MANAGEMENT ALTERNATIVES FOR MEETING WATER DEMANDS IN TUPELO-LEE COUNTY, MISSISSIPPI,
Mississippi State Univ., Mississippi State. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6D.
W83-03722

6D. Water Demand

GROWTH OF THE MUNICIPAL WATER SYSTEM IN CIUDAD JUAREZ, MEXICO,
Texas Univ. at Austin. Dept. of Geological Sciences.
For primary bibliographic entry see Field 5F.
W83-03502

GROUNDWATER RESOURCES OF THE TEXAS RIO GRANDE BASIN,
Texas Univ. at Austin. Dept. of Environmental Health Engineering.
For primary bibliographic entry see Field 2F.
W83-03503

WATER-USE PRODUCTION FUNCTIONS OF SELECTED AGRONOMIC CROPS IN NORTHWESTERN NEW MEXICO, PHASE II,
New Mexico State Univ., Las Cruces. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2D.
W83-03560

RESEARCH NEEDS FOR CAPACITY PLANNING,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
D. T. Lauria.
Journal of the American Water Works Association, Vol 75, No 1, p 14-19, January, 1983. 40 Ref.

Descriptors: *Future planning, *Water supply development, *Water demand, *Capacity, *Model studies, *Research priorities, Water supply, Multipurpose reservoirs, Storage reservoirs, Water treatment facilities, Pumping plants, Water costs, Community development.

Capacity planning for water supply facilities includes consideration of not only size but also location and when to build. Demand plays an important role in capacity planning. Facilities are classified as single or multi-purpose units. Models and knowledge of capacity planning should also be classified according to the purpose of the system, its type, the state of its water demand and the responsiveness of demand to price. Components influencing capacity planning for major community water systems include supply reservoirs, pumping stations and treatment plants, transmission mains, distribution, networks and water storage tanks. Research needs for capacity planning as identified by a special Environmental Protection Agency subcommittee include applications, price-sensitive models, unified system design, network models, and uncertainty. Research needs in the area of uncertainty should address the categories of supply and demand, system failure, costs, standards, and technology. (Geiger-FRC)
W83-03639

A RESEARCH AGENDA FOR MUNICIPAL WATER DEMAND FORECASTING,

Johns Hopkins Univ., Baltimore, MD. Dept. of Geography and Environmental Engineering.
J. J. Boland.
Journal of the American Water Works Association, Vol 75, No 1, p 20-23, January, 1983. 49 Ref.

Descriptors: *Water demand, *Future planning, *Forecasting, *Model studies, *Research priorities, *Water requirements, Projections, Water use, Decision making, Water management, Management planning, Prediction.

When making investment decisions for planning and managing water supply systems, the long-range forecasting of water demand is of utmost importance. Water demand forecasts can be categorized according to purpose or complexity of the water model used. Current forecasting practice usually relies solely on a single coefficient method, the per capita model. Multiple coefficient models have been applied in both aggregate and disaggregate forecasting. Demand models differ from requirement models in that they must possess a clear linkage to water use. Most demand models include weather-related variables when dealing with thhe residential sector. Research needs for the future should focus on creating demand models for users in multifamily residential structures or for nonresidential users. Further research is also needed to identify a more complete list of the variables that affect seasonal water use and to create fully probabilistic forecasting methods, especially where the cost of errors in forecasting is large. (Geiger-FRC)
W83-03640

SALINITY AND RESOURCE DEVELOPMENT PROBLEMS IN EAST KENT,
For primary bibliographic entry see Field 6G.
W83-03645

INCREASING ROCKPORT'S WATER SUPPLY,
Metcalf and Eddy, Inc., Boston, MA.
J. F. Shawcross, and D. Atkinson.
Journal of the New England Water Works Association, Vol 96, No 4, p 337-352, December, 1982. 5 Fig, 6 Tab.

Descriptors: *Water supply development, *Water demand, Rockport, *Massachusetts, Planning, Water management, Land use, *Water shortage, Alternative planning, Public opinion, Case studies.

The program which was used to identify and quantify new sources of water supply for the town of Rockport is reviewed. Some of the controversies surrounding the projects are described, and the program of emergency actions taken by the Town's engineering staff to continue the water supply until permanent new sources can be constructed is outlined. The shortage of water in Rockport results from the geological nature of the area, the growth of demand prior to 1979, and the inability of the community to overcome the complex problems existing in the time available. An emergency action program has prevented the town from running dry, but the situation is extremely precarious. There are undeveloped sources in the town which could provide adequate water through the year 2000. Development of these sources has been opposed by a variety of individuals and groups of interested people who for one reason or another feel that the development of one or more of the new sources is undesirable. The town is holding meetings to discuss various alternatives. It is hoped that actual construction will start late in 1982 and be completed by 1984, to include increasing the storage capacity of Cape Pond, developing permanent pumping facilities on Saw Mill Brook and Mill Brook, rehabilitation of the water treatment plant, additional storage tanks and new mains. As of September 18, 1981, a supply of 25 days of water was on hand. (Baker-FRC)
W83-03662

THE FEASIBILITY OF ENGINEERING-ECONOMIC-MANAGEMENT ALTERNATIVES FOR MEETING WATER DEMANDS IN TUPELO-LEE COUNTY, MISSISSIPPI,
Mississippi State Univ., Mississippi State. Dept. of Civil Engineering.
V. L. Zitta, R. L. Frnka, and W. McDonald.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-249631, Price codes: A06 in paper copy, A01 in microfiche. Water Resources Research Institute Completion Report, April 1983, 109 p, 7 Fig, 10 Tab, 48 Ref, 1 Append. A-136-MS(1), 14-34-0001-2126.

Descriptors: *Conjunctive use, *Water supply, *Water rates, Management, Linear programming, Planning, Groundwater, Surface water, *Mississippi, Tupelo-Lee County, *Water demand, Social aspects, Economic aspects, *Alternative planning.

The study provides a framework for assessing the feasibility of alternative water supply sources emphasizing allocation of costs in a given situation and provides a set of management criteria for determining a system of water pricing consistent with econmomic and social priorities in the Tupelo-Lee County Area in Mississippi. The solution approach utilized a linear programming technique where the objective function, consisting of cost coefficients for surface and well sources times the quantity of water used from each source, was minimized. This function was subject to both physical and water policy restraints where (1) all demands were met and (2) the demand from any one source did not exceed the supply. From a sampling of public water systems in the U. S., rank correlations between pricing systems and expressed objectives were computed in order to establish a basis for the selection of an efficient water rate structure.
W83-03722

SOME CURRENT PROBLEMS IN INVESTIGATIONS OF THE INTERACTION OF SUBSURFACE AND SURFACE WATERS OF THE USSR,
Vsesoyuznyi Nauchno-Issledovatel'skii Inst. Gidrogeologii i Inzhenerdoi Geologii, Moscow (USSR).
G. V. Kulikov, and V. V. Kurennoi.
Water Resources (English Translation), Vol 9, No 2, p 144-148, March-April, 1982. 1 Tab. Translated from Vodnye Resursy, No 2, p 46-52, March-April, 1982.

Descriptors: *Subsurface water, Surface water, *USSR, Water transfer, Water resources, Water supply, Groundwater, Water supply development, Water demand, Conjunctive use, *Surface-groundwater relations.

Studies are being conducted in river valleys to characterize the interaction of subsurface and surface waters under river valleys. The principals of schematization of hydrogeological conditions have been developed. Typical drainage schemes have been compiled. Approximate parameters and the concept of zone of deformation of the subsurface flow have been introduced. Attempts have been made to classify this interaction of subsurface and surface waters. The proposed classification is based on isolating the leading genetic factors of the interaction of the waters and performing a general evaluation of the extent and conditions of manifestation of these factors and the character of the balance direction of the processes. It should be noted that the natural conditions of the territory of the USSR include each of the distinguished types and all factors of the interaction of natural waters. Although tidal, hydraulic, and technogenic factors are manifested under more specific conditions, the targets of the effects of these factors have been inadequately studied and classified. The difference between the tidal and hydraulic factors of interaction follows from the uniqueness of the nature of the energy involved, cosmic and hydrographic, and the directions of the processes, i.e., rhythmic, inflow-outflow, and outflow. The main tasks in studying the interaction of subsurface and surface waters should be regionalization of hydrogeological and hydrological conditions of the country by types of interaction and in investigation of its regularities, with consideration of landscape and climatic zonation. It is necessary to develop a spacetime prediction and in general a theory of monitoring the interrelation of subsurface waters and their control. (Baker-FRC)
W83-03734

WATER TRANSFERS FROM AGRICULTURE TO INDUSTRY: TWO UTAH EXAMPLES,
Utah State Univ., Logan. Inst. for Social Science Research on Natural Resources.
R. L. Little, and T. R. Greider.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-253336, Price codes: A08 in paper copy, A01 in microfiche. Research Monograph No 10, June 1983. 160 p, 1 Fig, 45 Tab, 74 Ref, 1 Append. OWRT A-050-UTAH(1), 14-34-0001-1147.

Descriptors: *Social impact, Social change, *Social adjustment, Water rights, Community development, Power plants, Irrigation, Utilities, *Utah, *Water transfer.

The large scale transfer of water usage from agriculture to industry transforms a farming to a mining or industrial based economy and brings major social change. In order to develop a better understanding of the process, data were collected between 1980 and 1982 on the social effects of transferring water from agriculture to power production in two areas of Utah: Millard County near Delta and Emery County around Castledale. Questionnaires were mailed to water sellers and nonsellers, and interviews were conducted with community leaders. The results indicate considerable variation between the two areas. Nevertheless, roughly half the water sellers in both areas were agriculturalists, and the vast majority were longtime residents. In spite of the new-found cash, most sellers intended on remaining in their communities. Few intended on investing in more efficient irrigation systems. The two areas differ dramatically in their satisfaction with the process for negotiating water sales. Where selling was a unified effort, there was little desire for alterations in the process should future transfers become necessary. Where the power company negotiated sales with individuals, there was a perceived need for controls on future negotiations. Both areas experienced dissension from the water sales. However, the differed in the focus of their hostilities. Communities satisfied with the sales process reported deep antagonisms, and the hostilities were personalized as values and expectations were violated. Communities dissatisfied with the sales process directed antagonisms toward the power company. Overt hostilities have declined, but covert hostilities remain. Changes in the community social structure appear to have occurred in both areas.
W83-03821

PREDICTING FUTURE WATER DEMAND,
Municipal Environmental Research Lab., Cincinnati, OH.
R. M. Clark, J. A. Goodrich, and J. I. Gillean.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 108, No EE6, p 1248-1264, December, 1982. 9 Fig, 11 Tab, 7 Ref.

Descriptors: *Case studies, *Water demand, *Urban areas, *Water supply development, *Future planning, *Population dynamics, Water use, Urban planning, Water supply, Wastewater facilities, Water treatment facilities, Water requirements, Prediction, *District of Columbia, Metropolitan Washington D. C.

The decentralization of metropolitan populations over the past few years has affected water supply planning, making it difficult to forecast future demands for water and wastewater services. A case study of the Metropolitan Washington, D. C. area was undertaken to illustrate a method for forecasting water requirements via data on spatial population density and per capita demands. The technique is based on the estimation of water use by demand sector and by location of demand according to population and employment growth patterns. The technique studies water use in terms of both residential and nonresidential demand and can demonstrate total demand, as well as demand location, peak requirements, average monthly demand quantities, and location of demand points. This information, when combined with extrapolated demand coefficients, can be used to forecast quan-

tity and location of demand to aid in water supply planning in urban areas. (Geiger-FRC)
W83-03835

DISPLACEMENT OF RECREATIONAL USERS BETWEEN THE LOWER ST. CROIX AND UPPER MISSISSIPPI RIVERS,
Clemson Univ., SC.
R. H. Becker.
Journal of Environmental Management, Vol 13, No 3, p 259-267, November, 1981. 2 Fig, 3 Tab, 22 Ref.

Descriptors: *Recreation, *Rivers, Decision making, Lower St. Croix River, Upper Mississippi River, Water management, Public opinion, Attitudes, Surveys, Social aspects, Water use, Water demand, Water quality requirements, Environmental quality.

Surveys of recreational use of the Lower St. Croix River and the Upper Mississippi River in 1977-78 revealed no relationship between user density and satisfaction on an individual basis. However, on a system basis it was observed that persons unhappy with the crowded conditions on the Lower St. Croix River changed their preference to the Mississippi. The Mississippi users as a group were more sensitive to user density than the Lower St. Croix group. During the summer of 1977 the Lower St. Croix River has 800,000 visitor days over 52 miles and the Upper Mississippi had 300,000 user days over 300+ miles. Persons seeking social recreation were inclined to visit the Lower St. Croix, and those prefering low density experiences, the Upper Mississippi. 'Water polluted', 'unsafe swimming', and 'litter and debris' were environmental quality indices selected as reasons for no longer visiting the Mississippi. (Cassar-FRC)
W83-03842

6E. Water Law and Institutions

PRINCIPLES FOR TRANSBOUNDARY GROUNDWATER POLLUTION CONTROL,
For primary bibliographic entry see Field 5G.
W83-03501

ADMINISTRATIVE COORDINATION IN THE IMPLEMENTATION OF AGRICULTURAL NONPOINT POLLUTION CONTROLS,
Illinois Univ. at Urbana-Champaign. Dept. of Agricultural Economics.
J. B. Braden, D. L. Uchtmann, and D. R. Prutton.
Illinois Water Resources Center Research Report No 171, August 1982. 72 p, 254 Ref.

Descriptors: *Nonpoint pollution sources, *Water pollution control, *Administrative agencies, *Agricultural wastes, Resources management, Soil erosion, Soil conservation, Pollution load, Policy making, State jurisdiction, Economic aspects.

Many administrative arrangements have been made to restore and maintain the nation's water quality pursuant to the Federal Water Pollution Control Act Amendments of 1972. However, the arrangements to implement agricultural nonpoint pollution control programs reflect the difficulties surrounding agricultural nonpoint pollution. The physical processes resulting in sediment, plant residue and chemical pollution are not fully understood. Thus, most states have shied away from major political or financial commitments to pollution control and have not exercised pollution control authority because enforcement would be difficult without hard evidence of culpability. Soil loss has become a major proxy indicator for pollution problems but this has shifted the burden to soil conservation districts to implement primary agricultural nonpoint pollution control programs. Cutbacks in federal funding and little additional state and local support make the district's capabilities to carry out these programs questionable. The soil conservation agencies have the infrastructure to implement control programs (whereas pollution control authorities don't) but their goals are not always in concert with pollution control. Nonpoint pollution varies in composition and severity among states, and few have done more than identify and plan abatement activities. Targeting control efforts are needed as are criteria for abatement control and for directing funds toward critical areas. The ideal strategy would be a multipurpose resource management agency which would allocate state and federal funds as well as require pollution control actions by landowners, with suitable compensation. (Atkins-Omniplan)
W83-03559

WATER RIGHTS TRANSFERS: A LEGAL, ECONOMIC, AND INFORMATIONAL ANALYSIS OF WATER IN OREGON,
Oregon State Univ., Corvallis. Dept. of Agricultural and Resource Economics.
R. G. Kraynick, G. W. Whittaker, B. P. Bhadra, H. H. Stoevener, and J. L. Huffman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-235283, Price codes: A15 in paper copy, A01 in microfiche. Water Resources Research Institute Publication WRRI-78, Oregon State University, Corvallis, May 1983. 339 p, 18 Fig, 19 Tab, 175 Ref, 4 Append. OWRT B-069-ORE(1), 14-34-0001-9130.

Descriptors: *Water law, *Water rights, *Water rights transfers, *Doctrine of Prior Appropriation, *Appropriative rights, Legal aspects, Economic aspects, *Econometrics, Agriculture, Conservation, Judicial decisions, *Oregon, Surveys, Water users, Mathematical models, *Oregon, North Powder River.

The doctrine of prior appropriation (DPA) poses theoretical and practical constraints on decentralized exchanges of water rights, owing to universal non-impairment provisions in statutes of states using DPA. Five issues concerning efficacy of DPA water right transfer system in Oregon were explored: administrative, legal, economic, joint legal-economic, and informational. (1) Administrative: record inspection (1970-1980) revealed that few transfers are accomplished in Oregon, with almost no exchanges between individuals. (2) Legal: enhanced transfer processes can affect efforts to conserve water by reducing legal uncertainty concerning the extension of conserved water to new lands or sales of conserved surpluses, an ambiguous matter in Oregon court findings. (3) Economic: an enhanced statistical procedure for evaluating the productivity of water used in agricultural processes was tested. (4) Joint legal-economic: examination of Oregon's DPA in modeling context provided a means of determining the norms the statutes are supposed to achieve and desirable market-enhancing revisions in the statutes. (5) Informational: responses from individuals in a survey indicate (1) few attempted sales or purchases, (2) few have knowledge of the legal transfer process, and (3) the sale of water conserved or extension of water conserved to new lands is a desirable option.
W83-03594

GROUNDWATER PROTECTION ON THE LOCAL LEVEL: INTEGRATING THE FRAGMENTS OF REGULATION,
For primary bibliographic entry see Field 5G.
W83-03628

CHANGING THE CLEAN WATER ACT: REFLECTIONS ON THE LONG-TERM.
Journal of the Water Pollution Control Federation, Vol 55, No 2, p 123-129, February, 1983.

Descriptors: *Water quality control, *Standards, *Wastewater treatment, Clean Water Act, Water pollution control, Effluent limitations, Water quality standards, Regulations, State jurisdiction, Federal jurisdiction, Industrial wastewater, Planning, Enforcement, Legal aspects, Financing, Permits, Legislation, Grants, Construction.

Since the present goals of the Clean Water Act cannot be met, proposals to fine-tune this basically sound legislation are presented. Dropping the 1985 date and extending the 1983 goal to 1993 would allow for 2 complete planning and evaluation cycles. The technology-based approach must be preserved. Overtreatment of wastewater should be minimized by considering the assimilative capacities of the receiving waters. It is recommended that appropriations for state program grants be maintained through 1993 to provide enough time for the states to develop alternative sources of funds. Much research and development should be shifted to the states, with a clearing house to avoid duplication of effort. Municipalities should be encouraged to provide wastewater treatment services as public utilities, thus developing funds for operation and eventual replacement of facilities. Current enforcement provisions of the Clean Water Act have been reasonably effective and should be retained. Options for strengthening the program include requiring discharges to publicize serious violations, imposing fines by administration rather than by court action, and bans on new connections to wastewater systems if necessary. Economic incentives for better water quality are payment to municipal treatment plants for good performance, use of circuit riding consultants, promotion of industrial waste exchanges to promote recycle and reuse, and encouragement of innovation by cash awards. (Cassar-FRC)
W83-03635

LEGAL AND INSTITUTIONAL CONSTRAINTS AND OPPORTUNITIES IN WETLANDS ENHANCEMENT,
S. McCreary.
In: Wetland Restoration and Enhancement in California, M. Josselyn, ed. California Sea Grant College Program Report No T-CSGCP-007, Tiburon Center for Environmental Studies, San Francisco State Univ., December 1982. p 39-52, 1 Fig.

Descriptors: *Wetlands, *Watershed management, *Institutional constraints, *Legal aspects, *Aquatic habitats, Estuaries, Habitats, Shore protection, Policy making, Coastal zone management, Ecosystems, Coastal marshes.

Wetlands restoration is guided by complex, overlapping laws, agency policies, and attitudes, while concurrently trying to reverse the trend towards loss of valuable habitats through catastrophic events (major dredging or filling projects) and gradual degradation (excessive siltation, loss of buffers, or interruption of freshwater flows). This paper gives an overview of the legal and institutional issues in California, including the evolution of state policy towards wetlands protection, federal trends in wetlands management, institutional issues surrounding land acquisition, watershed management and protection, the role of scientists in enhancement, and the role of citizen activists and non-profit organizations. California is also developing programs to manage unit resources--coupling the land side of the coastal zone together with the water side thus creating a unified zone of watershed, shoreline, and waterbody. Various management techniques are used, including land use regulation, land acquisition by public agencies, and on-site stewardship. Ten recommendations are offered to move from general goals towards comprehensive implementation plans: make restoration an explicit resource policy goal; simplify the permit process; develop mechanisms that enable negotiations for off-site mitigation; improve methods to involve scientists and scientific information; refine the ecosystem management strategy; streamline the land acquisition process; expand the role of non-profits as land acquisition agents; recognize watershed as the logical unit for ecosystem management; recruit the private sector for technical/financial support; and unify the fragmentary wetlands restoration community. (Atkins-Omniplan)
W83-03692

TECHNOLOGY TRANSFER PROGRAM: URBAN STORMWATER MANAGEMENT IMPLEMENTATION IN IOWA,
Iowa State Univ., Ames. Dept. of Civil Engineering.
For primary bibliographic entry see Field 4A.
W83-03696

STATE OPTIONS FOR NONSTRUCTURAL FLOOD RISK MANAGEMENT,
Duke Univ., Durham, NC. School of Forestry and Environmental Studies.
For primary bibliographic entry see Field 6F.
W83-03702

A COMPARATIVE EVALUATION OF GROUND-WATER MANAGEMENT TECHNIQUES,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
For primary bibliographic entry see Field 4B.
W83-03704

LEGAL ANALYSIS OF THE LEE COUNTY WATER SUPPLY PROBLEM,
Mississippi State Univ., Mississippi State. Water Resources Research Inst.
M. C. Jarman, A. L. Sage, III,, and W. Hooper, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-249615, Price codes: A04 in paper copy, A01 in microfiche. Completion Report, April 1983. 60 p, 40 Ref, 1 Append. A-183-MS(1), 14-34-0001-2126.

Descriptors: *Water law, *Water allocation, *Water rights, Water management, Water rates, Financing, Groundwater management, *Mississippi, Lee County, Conjunctive use, Water conservation, Water demand, *State regulation.

The rapid economic expansion of Lee County, Mississippi, has created a demand for water that will require the county to supplement its present utilization of groundwater with surface water by the year 2000. An engineering study conducted by the Tennessee Valley Authority has recommended a long-range plan that combines effective water conservation measures with a cost-effective conjunctive use of surface groundwater. This paper identifies and discusses legal issues that arise from the proposed plan as well as currently existing legal authority that is available for managing water resources in the Lee County area. The legal issues discussed include: (1) state regulation of surface waters, with primary emphasis on Mississippi's Water Conservation Law; (2) state regulation of groundwater, including discussion of Mississippi's very limited Ground Waters Act, different theories of groundwater regulation, and an examination of case law from Mississippi and other jurisdictions; (3) a discussion of three federal statutes, the Safe Drinking Water Act, National Environmental Policy Act of 1969, and the Rivers and Harbors Appropriation Act of 1899, that affect the proposed plan; (4) an analysis of the relative abilities of the Tombigbee River Valley Water Management District and the Lee County Board of Supervisors to implement the proposed plan; and (5) a discussion of district project, financing and rate making. The report includes some suggestions for revisions of current Mississippi water resources law.
W83-03720

INSTITUTIONAL FRAMEWORK FOR CONJUNCTION USE OF SURFACE AND GROUNDWATER IN TUPELO-LEE COUNTY, MISSISSIPPI: PHASE II,
Mississippi State Univ., Mississippi State. Water Resources Research Inst.
For primary bibliographic entry see Field 4B.
W83-03721

WATER RIGHTS, WATER REGULATION, AND THE 'TAKING ISSUE' IN HAWAII,
Hawaii Univ. at Manoa, Honolulu. Water Resources Research Center.
W. Kloos, N. Aipa, and W. B. C. Chang.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-249706, Price codes: A08 in paper copy, A01 in microfiche. Technical Report No 150, May 1983, 114 p. OWRT B-062-HI(1), 14-34-0001-1113.

Descriptors: *Water rights, *Riparian rights, *Legal aspects, Water allocation, Public trust doctrine, Groundwater, Streams, Constituional law, *Hawaii, *Native Hawaiian water rights, *Appurtenant water rights, In-stream uses, Regulatory mandate, McBryde v. Robinson, Constitutional mandate.

The unique situation concerning water rights in Hawaii presents some particular difficult legal questions. This report analyzes the Constitution, 'taking' issues involved if Hawaii were to move from its present, judicially created system of water rights to a system allocating water based on limited-duration permits. Such a problem arises under the Fifth Amendment of the United States Constitution (prohibiting the taking of property without just compensation) because present Hawaiian water rights, namely riparian, appurtenant and konohiki water rights,could be considered 'property'. Replacing such righs with permits of limited duration, or the failure to grant a permit to an existing inchoate use, might therefore be considered a taking. Hence, the issue as to whether or not compensation in such cases is constitutionally compelled casts a pall of legal and economic uncertainty over the adoption of a permit system. A model is developed for answering these questions based on the following steps: (1) the determination of the present state of water rights, (2) ascertainment of the degree to which these rights constitute 'property' in a constitutional sense, (3) an assessment of the degree to which a comprehensive regulatory system is required by the constitutional amendement on water resources, (4) a discussion of the desirability of a limited-duration permit system, (5) the derivation of a test for determining whether a taking has occurred, and (6) the isolation of different factual patterns which would raise a taking question. The constitutional analysis proceeds under the assumption of a pre-McBryde state of affairs since this presents a 'worst case' scenario and magnifies the constitutional issues involved. In conclusion, a limited duration-permit system is recommended as a constitutionally permissible and viable means of maintaining the needed flexibility to meet future demands and shifting uses.
W83-03779

6F. Nonstructural Alternatives

STATED FINANCING POLICIES OF GOVERNMENT AGENCIES AND THE EXPERIENCE OF RURAL WATER SUPPLY SYSTEMS,
Cornell Univ. Agricultural Experiment Station, Ithaca, NY. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6A.
W83-03606

MAKING WAVES: PUBLIC PARTICIPATION IN STATE WATER PLANNING,
North Carolina Univ. at Chapel Hill. Dept. of City and Regional Planning.
D. R. Godschalk, and B. Stiftel.
Journal of Applied Behavioral Science, Vol 17, No 4, 1981. p 597-614, 2 Fig, 6 Tab, 16 Ref. OWRT A-096-NC(4), 14-34-0001-9035.

Descriptors: Water quality, *Public participation, Decision making, *Policy making, Management planning, Water pollution control, Public policy, Public opinion, Environmental policy, North Carolina.

In North Carolina the 208 plan is the response to Federal Law which requires states to control sources of water pollution, and to facilitate public participation in planning for water quality management. An evaluation was made of public participation in 208 planning. The middle-class, self-interest bias was found in the NC program as in most U. S. public participation. Despite earnest efforts to involve a broad spectrum of the public, leaders of affected interest groups-farm, business, and local government-dominated participation. Initially, state water planners sought public support for stronger regulation of pollution sources, but ended with a considerably milder plan in which mandatory regulation was shelved in favor of voluntary compliance by pollution produces. People without a direct economic interest largely failed to participate, thus if the state planners had concentrated on mobilizing environmental and civic activists, they probable would have generated more support for strong regulations. Because the final plan recommendations were more closely in agreement with participant opinion than were earlier drafts or staff positions, the public can be expected to give greater support to the 208 plan as a result of participation. This work presents an approach to public participation evaluation research that can be used to refine existing participation theory.
W83-03614

MANAGING THE RISK AND LIABILITY OF TOXIC CONTAMINATION OF WATER SUPPLY,
Geomet Technologies, Inc., Rockville, MD.
R. T. Allen, C. I. Judkins, Jr, and W. E. McQueeney.
Journal of the New England Water Works Association, Vol 96, No 4, p 286-297, December, 1982.

Descriptors: Water pollution sources, *Liability, *Legal aspects, Insurance, *Groundwater contamination, *Risks, *Water pollution control.

Well closings are occurring nationwide due to contaminstion of their waters with organic compounds, insecticides, chlorides, nitrates, metals, inorganics, landfill leachates and industrial wastes. The primary cause of groundwater contamination is inappropriate waste disposal practices. It is noted that 12 separate epidemiological studies have implicated waterborne carcinogens in excess cancer mortality. At present, 90% of the toxic chemicals in drinking water remain unidentified. The legal aspects of insurance for the water companies and their employees as well as the local township managment against injury from contaminated water are considered. A strategy is presented to manage the risk and liability of toxic contamination of water supplies. The first segment of the strategy calls for interviews, surveys, and mappings of the area proximate to the water source in order to obtain a rough estimate of the risk of toxic contamination, any threat to human health, and potential liability claims upon the utility. The second segment is a preliminary analysis of the raw water via appropriate GC/MS and atomic absorption analysis of samples. Third is a detailed analysis of problematical sites; and fourth is the design and implementation of programs to maintain quality, advise and assure customers and cope with liability aspects including appropriate insurance, periodic audits, water quality monitoring steps, interface with regulatory bodies, and communication with the public and customers. (Baker-FRC)
W83-03630

THE ESTIMATION AND APPLICATION OF THE DEMAND FOR DISCHARGE WITHIN THE CONTEXT OF WATER QUALITY MANAGEMENT SYSTEMS,
Clemson Univ., SC. Dept. of Economics.
M. T. Maloney.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-246504, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Research Institute Publication No 105, Clemson Univ., SC., June 1983. 65 p, 4 Tab, 65 Ref. OWRT B-128-SC(1), 14-34-0001-0246.

Descriptors: *History, *Standards, *Marketing, *Institutions, *Water quality standards, *Effluent charges, Economic aspects, Water quality, Impaired water quality, Planning, *Costs, Comparative costs, Incremental costs, Cost estimation.

This study is composed of three parts. The first is a history of water pollution control legislation following the 1972 Federal Water Pollution Control Act. Part two is a theoretical investigation of pollution control institutions. The third section is a review of an analytical technique helpful in estimating the value of transferability of pollution permits. The history of water pollution control regulation shows the divergence of actual regulatory practices from those advocated by policy analysts. Practice has tended toward the approaches where compliance was most easily monitorable. It is often omitted monitoring cost element

which is built on section two. There it is argued that to the extent any discretion is left to independent economic agents in adjusting pollution levels, transferable permits are superior to other approaches. Taxes force the problem of inducing unacceptably large levels of pollution should the tax be inappropriately set. Moreover, compliance monitoring is no less difficult. Standards have been the regulatory approach of choice because of monitoring. An estimate of the gains from shifting the regulatory regime away from standards towards transferable permit is useful in weighting the administrative costs of such a move. Section three develops a method for obtaining such an estimate based on the limited information generalized by the standards rule.
W83-03701

STATE OPTIONS FOR NONSTRUCTURAL FLOOD RISK MANAGEMENT,
Duke Univ., Durham, NC. School of Forestry and Environmental Studies.
J. P. Royer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-246512, Price codes: A07 in paper copy, A01 in microfiche. Water Resources Research Institute Report No 196 North Carolina State Univ., Raleigh, June 1983. 133 p, 17 Fig, 3 Tab, 95 Ref, 3 Append. OWRT B-140-NC(1), 14-34-0001-1255.

Descriptors: *Flood plain management, *Nonstructural alternatives, *Public policy, *Planning, *Land use, Flood plains, Economic aspects, Cost-benefit analysis, Local governments, State jurisdiction, Legislation, Policy making, Flood Plain zoning, Coastal zone management, Insurance, *North Carolina.

Options for a program of nonstructural flood risk management in North Carolina are examined through analyses of (1) current state legislation governing flood plain management, (2) land-use patterns on North Carolina flood plains, (3) the attitudes of local officials toward alternative measures for nonstructural flood risk management, and (4) simplified methods for evaluating the costs and benefits of flood plain regulation and acquisition. The analyses reveal opportunities to modify existing policies toward flood plain management in the state; with efforts concentrating on (1) broadened local authorities for regulating flood plains and (2) expanded programs of technical and financial assistance by the state under a designated lead agency with a full-time interdisciplinary staff for flood plain management.
W83-03702

INDUSTRIAL WASTEWATER PRETREATMENT STANDARDS--A LOCAL APPROACH,
Burns and McDonnell, Kansas City, MO.
W. H. Lovell, S. A. Christopher, R. Ream, and R. Tippets.
Public Works, Vol 114, No 1, p 33-35, January, 1983. 2 Tab.

Descriptors: *Industrial wastewater, *Pretreatment of wastewater, *Effluent limitation, Wastewater treatment, St. Joseph, *Missouri, Standards, Regulations, Water quality control, Water pollution control, *Water quality standards.

St. Joseph, Missouri, has developed an industrial wastewater pretreatment program based on local industrial conditions and the capacity of the city treatment works. Forty-nine of the total of 175 diversified industrial plants contribute about 30% of the total wastewater. After establishing a list of maximum allowable pollutant concentrations for the municipal treatment plant influent, individual disagreements were worked out. Enforcement is flexible, allowing a variance for a limited period of time during which the pretreatment system is developed. Industries submit a compliance report semiannually. The city also monitors industrial discharges to verify the reports. If a suspension order is issued, the industry must stop contributing to the treatment plant until remedial action is taken. (Cassar-FRC)
W83-03765

IRRIGATION FUNDING NOW MORE RATIONAL,
J. Bornholdt.
New Zealand Journal of Agriculture, Vol 145, No 6, p 11, December, 1982.

Descriptors: *Irrigation, *Financing, *Loans, *New Zealand, Spray irrigation, Water policy, Economic aspects, Subsidies.

New Zealand's irrigation funding policies have been changed so that all schemes are on an equal basis. A 70% overall subsidy for off-farm developments applies to community and private schemes. A new rural bank loan is available to finance on-farm schemes. It allows for no repayment during the first three years of the loan. As a result of the policy change spray irrigation, an efficient user of water, is now eligible for loans on favorable terms. (Cassar-FRC)
W83-03811

INTERACTIVE NONSTRUCTURAL FLOOD-CONTROL PLANNING,
Camp, Dresser and McKee, Inc., Annandale, VA.
S. A. Hanson-Walton.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 108, No WR3, p 333-334, October, 1982. 1 Ref.

Descriptors: *Flood damage, *Flood plain management, *Nonstructural alternatives, Planning, Flood control, Red Run River, Lower Clinton River, *Michigan.

A comment on 'Interactive Nonstructural Flood-Control Planning' by George F. McMahon, published in the Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, October, 1981, points out that the described planning tool is not economically feasible for the analysis of large numbers of structures (10,000). The Structures Inventory of Damages (SID) program and the Expected Annual Flood Damage (EAD) computation program were used together to study 75,000 structures on 357 reaches in the Red Run-Lower Clinton River watershed near Detroit, Michigan. SID calculates possible changes from representative samples. The EAD finds the damage-frequency relationship for each reach using the stage-damage relationship generated by the SID program. (Cassar-FRC)
W83-03831

6G. Ecologic Impact Of Water Development

SALINITY AND RESOURCE DEVELOPMENT PROBLEMS IN EAST KENT,
P. W. Herbertson.
Journal of the Institution of Water Engineers and Scientists, Vol 36, No 6, p 415-436, December, 1982. 8 Fig, 5 Tab, 6 Ref.

Descriptors: *Saline water, *Agriculture, *Water resources development, Irrigation water, Reservoirs, Marshes, Mine drainage, Estuaries, Water management, Stour Estuary, *United Kingdom, Water use.

The salinity regime of the Lower Stour Estuary system in East Kent was investigated to predict the effects of further water abstraction on water quality. A major source of saline water other than seawater is discharges from several collieries. The river basin contains many former marshes now used for culture of a wide variety of crops and for livestock raising. The Richborough Power Station is licensed to abstract 136.8 ML per day of cooling water. A public water supply reservoir was proposed and rejected because it was deemed too intrusive to the valley. Increasing summer demands led to the request for additional abstraction from the tidal river. Modeling of the estuary system indicated that under low flow conditions the irrigation water quality would be difficult to maintain, that the mine water discharge was a significant factor, that increasing agricultural demands would require improvement in water quality or in the existing gravity marsh feeding facilities, and that the proposed reservoir could increase the available water to the marshes by 40%. It was recommended that the mine discharges be diverted via a 6 km pipeline to join a pipeline emptying into the sea and that pumping stations be installed to feed the marshes. (Cassar-FRC)
W83-03645

HYDROLOGIC EVALUATION OF SMALL IMPOUNDMENTS IN ARID AND SEMIARID REGIONS,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
D. D. Evans, D. W. Young, and L. P. Onyskow.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-243063, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Center Completion Report, Tucson, Ariz., June 1983. 33 p, 6 Fig, 21 Ref. A-083-ARIZ(1), 14-34-0001-8003.

Descriptors: *Reservoir siting, *Hydrology models, Water loss, Seimiarid lands, Southwest U. S., *Arizona, Model studies, Sonoita Creek watershed, Impoundments, Reservoir releases, Simulation.

In the arid and semiarid regions of the Pacific Southwest there is interest in the further development of small impoundments of water for recreation or other purposes by private enterprise or government agencies. Such impoundments have downstream hydrologic impacts which need to be evaluated prior to construction. The objective of this research was to develop a scheme for evaluation which is simple and has minimum data requirements. A model was constructed whereby the potential hydrologic impacts of small reservoirs can be evaluated prior to their construction. The methodology is simplistic and requires easily obtainable data, so that numerous modifications to such variables as reservoir capacity, spillway releases and controlled releases can be made and analyzed in a short peiod of time. Several models were evaluated for simulating rainfall/runoff, lake water balance, and downstream surface hydrologic impacts for controlled and uncontrolled releases for a proposed reservoir. The models were tested with data from the Sonoita Creek watershed in Southern Arizona, which contains a 200 acre impoundment. No simple model was found to adequately describe rainfall/runoffs for an ungaged watershed.
W83-03667

POPULATION BIOLOGY IN SMALL HAWAIIAN STREAMS,
Hawaii Univ. at Manoa, Honolulu. Water Resources Research Center.
R. A. Kinzie, III., and J. I. Ford.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-243154, Price codes: A05 in paper copy, A01 in microfiche. Technical Report No 147, October 1982. 83 p, 17 Fig, 13 Tab, 34 Ref. OWRT A-080-HI(1), 14-34-0001-1113.

Descriptors: *Fish populations, Freshwater fish, *Fish genetics, *Crustaceans, Biology, Ecology, Streams, *Lentipes concolor, *Threatened species, Maui, Kauai, Molokai, Oahu, *Hawaii.

Intensive stream surveys were conducted on Maui and Kauai in Hawaiian island streams during October 1979 through 1982 to investigate whether the presence of predaceous eleotrids in terminal reaches of low-gradient streams excluded the rare goby, Lentipes concolor, from this habitat and restricted it to higher elevations. An attempt was also made to determine whether a correlation exists between seasonality of stream discharge patterns and the two life history parameters (spawning and recruitment) of the indigenous, diadromous species. Two small perennial streams, Pua'alu'u and Pepeiaolepo, on the island of Maui, and another small stream, Maunapuluo, on the precipitous Na Pali Coast of Kauai were selected as study areas. Although evidence indicated that Eleotris

sandwicensis preys upon gobies and rarely coexists with Lentipes, many other factors influence the effectiveness of Eleotris as a predator. Factors affecting the distribution and abundance of Lentipes are complex. No sharply defined periodicity was found in the recruitment of diadromous fishes, crustaceans, or mollusks. In-stream factors, among-stream and among-island differences in physical and biotic parameters apparently make recruitment into small Hawaiian streams an event in which chance plays a dominant role. In larger streams these stochastic processes may be averaged out and populations of these indigenous animals are more stable. The importance of these physical, biotic factors in determining the disturbance of populations of native stream fauna is discussed.
W83-03676

DEVELOPMENT OF REGIONAL WETLAND RESTORATION GOALS: COASTAL WETLANDS,
California Coastal Commission, San Francisco.
J. Zentner.
In: Wetland Restoration and Enhancement in California, M. Josselyn, ed. California Sea Grant College Program Report No T-CSGCP-007, Tiburon Center for Environmental Studies, San Francisco State Univ., December 1982. p 24-31.

Descriptors: *Wetlands, *Coastal waters, *Watershed management, *Regional development, *Watershed development, Standards, Wildlife habitats, Habitats, Shore protection, Primary productivity, Tidal lands, Salt marshes, Tidal flats, Water birds, Wildlife.

Of 381,000 acres of coastal wetlands in California prior to 1900, only 105,000 acres remain today. The California Legislature resolved that in the next 20 years, 50% more wetlands should be created; however, to be successful, a restoration plan must determine what types and how much of particular habitats are most needed, or valuable for each restoration project. Coastal wetlands have a set of values and each value has a recognized utility. Eight values are cited as representing the values of wetlands: high primary productivity, shoreline protection, wildlife habitat, water purification, groundwater recharge, flood protection, habitat for commercially important fish and shellfish, and cultural values, such as education and recreation. The major value of California's coastal wetlands is as a plant and wildlife habitat. These wetlands have little value for most commericial fish or as horseline protectors, water purifiers, groundwater rechargers or flood controllers. Primary productivity of wetlands is high but wildlife utilization of that production occurs within the wetland. Cultural values depend on the wetland's value as a plant and wildlife habitat. Additionally, of 12 endangered or rare California species of birds, reptiles and mammals, nine are residents of or associated with coastal wetlands and five are almost entirely dependent on salt marshes. The creation of habitat for wildlife and human use should be the major restoration goal on a statewide basis, but each habitat's latitude must be considered. The values for the North, Central and South regions are different, therefore, the restoration goals must be resolved within their regional frameworks. (Atkins-Omniplan)
W83-03691

INSTREAM FLOW REQUIREMENTS FOR FISH AND FISHERIES IN MARYLAND,
Maryland Univ., Solomons. Chesapeake Biological Lab.
For primary bibliographic entry see Field 2E.
W83-03776

MACROINVERTEBRATE COLONIZATION OF MULTIPLATE SAMPLERS IN THE OHIO RIVER: THE EFFECT OF DAMS,
Cincinnati Univ., OH. Dept. of Biological Sciences.
D. C. Beckett, and M. C. Miller.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 39, No 12, p 1622-1627, December, 1982. 1 Fig, 3 Tab, 29 Ref.

Descriptors: *Dam effects, *Invertebrates, *Water currents, *Ohio River, Macroinvertebrates, Aquatic habitats, Flow velocity, Amphipods, Midges, Aquatic insects, Aquatic animals, *Environmental effects.

The effects of river current velocity on macroinvertebrate colonization of multiplate samplers were studied in fast and slow currents (downstream and upstream of a surface release dam) in the Ohio River in 1979. Slow water colonies were dominated by the amphipod, Gammarus sp.; fast water colonies, by hydropsychid caddisflies. The winter stonefly Taeniopteryx burksi and the chironomid Polypedilum illinoense were significantly more abundant in slow water; the chironomids Cricotopus bicinctus, P. convictum, and Rheotanytarsus sp., and the caddisfly Hydropsyche orris were more abundant in fast water. When colonized sampler plates were moved to the opposite type of current, the colonies gradually changed composition with time to form communities more typical of the current velocity. These changes seemed to be independent of crowding of living space, dissolved oxygen, temperature, and conductivity of the water. (Cassar-FRC)
W83-03824

7. RESOURCES DATA

7A. Network Design

RIVER BASIN WATER QUALITY MONITORING NETWORK DESIGN,
Massachusetts Univ., Amherst. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5A.
W83-03593

7B. Data Acquisition

DEVELOPMENT AND CONSTRUCTION OF A STATIONARY MEASURING SYSTEM FOR LIMNOLOGICAL OBSERVATIONS ON THE AMMERSEE (ENTWICKLUNG UND BAU EINES STATIONAREN MESSSYSTEMS FUR LIMNOLOGISCHE BEOBACHTUNGEN AUF DEM AMMERSEE),
G. Michler, and B. Wuschansky.
Wasserwirtschaft, Vol 72, No 5, p 215-217, May, 1982. 3 Fig. (No English Summary).

Descriptors: *Measuring instruments, *Limnology, *Hydrometeorology, *Data collections, *Data interpretation, Data transmission, Floats, Floating measuring station, Ammersee, *Federal Republic of Germany, Electronic equipment, Microelectronics, Energy transfer, Metabolism, Phytoplankton, Air temperature, Water temperature, Costs, Ammersee.

A floating measurement platform with independently designed and assembled electronic equipment (based on the principles of microprocessors) for measuring, transmitting, receiving, and analyzing hydrometeorological and limnological data was constructed for use in the Ammersee (Federal Republic of Germany). The platform was designed to measure factors such as energy turnover on the lake surface, evaporation over a free water area, energy input via wind stress, temperature and density stratification, metabolism, population dynamics in relation to production factors, and sedimentation rate. Some of the parameters were suitable for continuous registration. The platform could hold six to eight persons and could be used for periodic studies to assess productivity (e.g., volume and composition of phytoplankton). It consisted of two floats, each made of four 216-liter oil barrels welded together. The platform was filled with 20 kg polyurethane foam to make it almost unsinkable. The floats were topped with wooden boards and railings. The atmospheric data collector and warning lights were carried on a 4-m-high mast. Electronic and voltage equipment was housed in a galvanized steel covered wooden chest. Two anchors were fashioned, each from five concrete-filled and steel-armored automobile tires. The platform was anchored 750 m from the lake bank (water depth, 21 m). Due to adverse weather and lake conditions and to the large number of cable cores (96) required, analog data values were digitalized and transmitted serially to the analyzing device via one carrier. The majority of the measuring capacity was used to determine temperature. Equipment for lighting protection was installed. The cost of the platform was 3,000 DM, that of the electronic equipment was 6,000 DM. (Gish-FRC)
W83-03527

AUTOMATIC DETERMINATION OF SNOW COVER (SCHNEEDECKE AUTOMATISCH ERFASST),
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Versuchsanstalt fuer Wasserbau, Hydrologie und Glaziologie.
B. Schadler, and F. Koch.
Wasser, Energie, Luft, Vol 73, No 1/2, p 15-16, January/February, 1981. 2 Fig, 3 Ref. English Abstract.

Descriptors: *Snow cover, *Gamma radiation, *Rain gages, *Soil moisture, *Measuring instruments, Gamma snow control, *Switzerland, Reservoirs, Potential water supply, Alps, Flood flow, Flood control, River flow, Water level, Snow depth, Snowmelt, Thaw, Water supply, Forecasting, River forecasting, Flood forecasting.

The ability to determine the water equivalent of winter snow cover is important in Switzerland, since the summer volume of many alpine reservoirs and the flow of Swiss midland rivers are dependent on this. An automatic device to perform this function is described: the gamma snow sound, whose measurements are based on the attenuation of gamma radiation as it penetrates a medium. The equation used to calculate this attenuation involves the relationship between the intensity of the gamma radiation, a medium-specific absorption coefficient, and the depth of the irradiated snow. The device, which has been in use since 1975, employs a cobalt-60 radioactive source of 7.5 millicuries (half life 5.25 yr). The same type of device may also be used to determine soil moisture: three Geiger-Muller (GM) counters are sunk into the soil, and the additional weakening of radiation intensity with increasing soil moisture allows an estimation of water content changes in the entire soil layer between the surface and the buried GM counters. Results can be printed out or stored. An example is given of measurements made in the winter of 1979/80 in the Rietholzbach catchment area (Switzerland). Snow cover built up from mid-December to its greatest depth on 23 January, when it was 85 mm water equivalent, which corresponded to a water reserve of 270,000 cu m for the area. A thaw accompanied by heavy rain ensured in February, after which a flood wave of 3,440 cu/m sec was measured on the Rhine at Rheinfelden. (Gish-FRC)
W83-03529

A QUESTION OF SAMPLING,
Welsh Water Authority, Powys (Wales). Directorate of Scientific Services.
D. G. Salker.
Effluent and Water Treatment Journal, Vol 22, No 5, p 184-185, 187-189, 191, May, 1982. 3 Fig, 10 Ref.

Descriptors: *Sampling, *Measuring instruments, *Design criteria, Sample preservation, Sample preparation, Water sampling, Biological samples, Water analysis, Chemical analysis, Pollutant identification.

A brief introduction to the concepts, applications and limitations of sampling as a means of water quality monitoring is presented. The nature of sampling is briefly discussed in addition to the practical aspects that are of assistance in answering questions such as what type of sample should be taken, where should sampling be done, when should samples be taken, how many are needed, and why sample at all. Sampling is an activity that may be used to abstract water quality information with great economy of effort, provided care is taken in all aspects of the planning of a scheme.

Good planning for sampling to be effective requires the following criteria and expertise to be met: a clear idea of the objective of the program, sound technical knowledge, and good judgement aided by statistical techniques where needed. In most cases discrete, intermittent sampling is used as opposed to continuous sampling for economic and other practical considerations. In choosing a position from which to sample, care must be taken to provide samples that are valid. Samples should be taken so as to reveal any differences in diurnal times, variations between days, weeks, months or seasons. There are two major types of samples: the single discrete sample and the composite sample. The number of samples needed to indicate various findings is discussed. (Baker-FRC)
W83-03595

EVALUATION OF A DISSOLVED OXYGEN FIELD TEST PROTOCOL,
National Bureau of Standards, Washington, DC. National Engineering Lab.
G. Kulin, W. W. Schuk, and I. J. Kugelman.
Journal of the Water Pollution Control Federation, Vol 55, No 2, p 178-186, February, 1983. 9 Fig, 4 Tab, 5 Ref.

Descriptors: *Dissolved oxygen, *Wastewater analysis, *Measuring instruments, Oxygen, *Wastewater treatment, Activated sludge process, Aeration, Calibration, Standards.

A test protocol developed for on-line dissolved oxygen meters was evaluated in a 60-day field test in an extended aeration activated sludge tank. Thirteen meters from seven manufacturers were tested. A portable dissolved oxygen meter was used as a transfer standard. Calibration was done with clarifier effluent. Experience during the test resulted in several suggestions for operating these meters. The portable reference probe should be slowly oscillated during readings to avoid entrapment of air bubbles. On-line meters should not be recalibrated on the basis of readings during the first day or two. The probe and its support structure should have smooth contours and interior wiring to prevent fouling with the stringy materials present in the tanks. The sensor should be exposed directly to the aeration basin, but not directly perpendicular to the strongest currents. Mechanical devices used to hold the probe assembly should allow quick release. The design should facilitate quick membrane replacements. Membrane and probe cleaning on a regular basis is not recommended unless readings indicate fouling. (Cassar-FRC)
W83-03631

ELECTROMAGNETIC DETERMINATION OF SOIL WATER CONTENT USING TDR: I. APPLICATIONS TO WETTING FRONTS AND STEEP GRADIENTS,
Department of Agriculture, Ottawa (Ontario). Land Resource Research Inst.
G. C. Topp, J. L. Davis, and A. P. Annan.
Soil Science Society of Americal Journal, Vol 46, No 4, p 672-678, July/August, 1982. 10 Fig, 18 Ref.

Descriptors: *Soil water, *Leaching, *Predicting, Soil moisture availability, Drainage, Dielectric constant, *Time-domain reflectometry.

The applications and limitations of time-domain reflectometry (TDR) are studied when used on parallel transmission lines for measurement in a field simulation. Experiments were conducted in a laboratory where simulations of wetting and drying were better controlled. The TDR method using parallel wire transmission lines is a practical and useful technique to measure soil water content averaged over depth even when steep gradients or wetting fronts are present. Where a uniform dielectric constant exists it is possible to measure both the distance to the wetting front and the amount of water behind the wetting front during an infiltration experiment if one uses the fact that the TDR trace shows the impedance difference between dry and wet soil. The water content measured by the TDR technique was found to be the same as the average water content to within 0.01 cubic cm/cubic cm in extremely nonuniform conditions. (Baker-FRC)
W83-03766

A PERMEAMETER WHICH ELIMINATES BOUNDARY FLOW ERRORS IN SATURATED HYDRAULIC CONDUCTIVITY MEASUREMENTS,
North Carolina State Univ. at Raleigh. Dept. of Soil Science.
R. L. Hill, and L. D. King.
Soil Science Society of America Journal, Vol 46, No 4, p 877-880, July/August, 1982. 4 Fig, 7 Ref.

Descriptors: *Permeability coefficient, *Measuring instruments, Permeameters, Acrylic swelling, Soil properties.

In many laboratory hydraulic conductivity measurements, flow of solution along the soil-permeameter wall interface is a major source of error. A permeameter is described which has been designed to eliminate boundary flow errors during such measurements. The permeameter is in three parts. The top and bottom sections are constructed from acrylic resin materials. The center section is an aluminum sleeve. In the experiments performed, the boundary flow consistently exceeded center flow by 54 to 23% during the first 154 h of leaching. Diminishing differences in hydraulic conductivity (K) between the two regions were attributed to slight swelling of the soil mass, movement of dislodged soil particles into the higher velocity region of the boundary flow, or both. Differences in the K for the boundary and center flow regions were not as great as in earlier studies; however, the soil used here was relatively nonexpansive. The permeameters appear to effectively eliminate boundary flow from the hydraulic conductivity measurement. Through the use of the removable aluminum sleeve, the permeameters offer advantages in adaptability to disturbed and undisturbed soil samples and in elimination of problems associated with acrylic swelling. (Baker-FRC)
W83-03770

A DEW-POINT HYGROMETER FOR FIELD USE,
Oregon State Univ., Corvallis. Dept. of Forest Engineering.
H. R. Holbo.
Agricultural Meteorology, Vol 24, No 2, p 117-130, June, 1981. 9 Fig, 1 Tab, 10 Ref.

Descriptors: *Hygrometers, *Dewpoint, *Humidity, Dewcels, Measuring instruments, Lithium chloride, Temperature, Evaporation.

A dewcel design has been used for measuring ambient dewpoint temperature at remote field sites. This hygrometer is based on the effectiveness of salts dissolved in aqueous solution to depress the equilibrium vapor pressure in the surrounding atmosphere. Lithium chloride is effective over a wide humidity range. The hygrometer's sensor is heated electronically rather than by conduction through salt solution, reducing size and power requirements of the unit. The sensor configuration differs from that of the Campbell version in that it has a 40% smaller surface area and uses fine-gage platinum electrodes, a tightly woven fiberglass fabric for holding the salt, and small-gage support wires. The bobbin heater is a vitreous-enameled wire-wound power resistor. Transistor heat-sink grease provides a thermal coupling between thermometer and bobbin. In field tests the dewcel design rarely departed from its calibration. Humidity-temperature discrepancies were rarely greater than 0.5C. It was necessary to keep the power turned on at all times while the lithium chloride solution was in the apparatus. On occasions when batteries went dead, dewcels were damaged by corrosion, and data was rendered useless. Damage was also caused by loose electrodes. (Cassar-FRC)
W83-03796

A SIGNAL RECORDING AND PRINTING SYSTEM FOR TELEMETERING RAINGAUGES,
Meteorological Office, Poona (India).
N. V. Iyer.
Mausam, Vol 33, No 3, p 355-360, July, 1982. 7 Fig, 2 Tab, 3 Ref.

Descriptors: *Rain gages, *Telemetry, *Data transmission, Remote sensing, Automation.

The automatic signal recording and printing system for telemetering rain gage data used by the India Meteorological Department is described. The receiver and tape recorder are automatically switched on and off before and after the scheduled transmission time. The keyed continuous wave data in the teleprinter code are converted to highs or lows corresponding to long or short notes and are stored in a shift register. Data can be stored on tape and printed out. (Cassar-FRC)
W83-03801

ELECTROMAGNETIC DETERMINATION OF SOIL WATER CONTENT USING TDR: II. EVALUATION OF INSTALLATION AND CONFIGURATION OF PARALLEL TRANSMISSION LINES,
Department of Agriculture, Ottawa (Ontario). Land Resource Research Inst.
G. C. Topp, J. L. Davis, and A. P. Annan.
Soil Science Society of America Journal, Vol 46, No 4, p 678-684, July/August, 1982. 9 Fig, 2 Tab, 6 Ref.

Descriptors: *Soil water, *Measuring instruments, Drainage, Infiltration, Permeability, Soil moisture availability, Time domain reflectometry, Dielectric constant.

Conditions where time-domain reflectrometry determined water content is both affected and not affected by the transmission line design are considered. TDR applied to parallel transmission in soil was used to measure the soil water contents during infiltration, drainage, evaporation, and rising water table conditions in a 1.05 m column of silt loam soil. Three types of installation and several types of transmission lines were evaluated. Comparisons of volumetric water content from gravimetric samples and from TDR showed differences were always less than 0.03 cubic cm/cubic cm. Lines with known electrical discontinuities provided a convenient and accurate way of determining water content profiles. In the silt loam soil used the reflections from discontinuities deeper than 60 cm were too small for confident interpretation at high water contents. The soil itself or some material with a dielectric constant larger than that expected in the soil should be used to fill the discontinuities unless corrections are made to the measurement. Installation of TDR lines in the field is not critical providing the rods are of small diameter for a 5-cm center-to-center spacing and the soil is tightly contacting the rod. The TDR technique using transmission lines in the soil offers great potential for measuring soil water content rapidly or for monitoring soil water content over long periods of time. (Baker-FRC)
W83-03806

7C. Evaluation, Processing and Publication

VARIATIONS IN MONTHLY PRECIPITATION OVER NORTH CAROLINA,
North Carolina Univ. at Chapel Hill.
B. K. Eder, J. M. Davis, and P. J. Robinson.
Report No 185, State Climatologist for North Carolina, Raleigh, January 1983. 55 p, 16 Fig, 1 Tab.

Descriptors: *Rainfall distribution, *Variability, *Precipitation, Rainfall, *Maps, *Climatic data, *North Carolina, Storage and retrieval.

This publication contains maps showing the distribution of mean monthly precipitation and variance across North Carolina for the thirty year period, 1951-1980. The spatial and temporal variability of precipitation over the state is examined through a statistical analysis of monthly normal precipitation data. Tables and maps derived from these data provide monthly precipitation means and standard

deviations for 85 locations in North Carolina. This report also contains information on data resources available, such as the Hydrological Information Storage and Retrieval System(HISARS), on the causes and distribution of precipitation in North Carolina, and on the use of the precipitation information. This report will be useful for both the general public and technicians in arriving at precipitation-related climatic decisions.
W83-03598

THE SNOWY RANGE OBSERVATORY: CLIMATOLOGICAL AND STREAMFLOW DATA REPORT 1982,
Wyoming Univ., Laramie. Water Resources Research Inst.
G. L. Kerr, and T. A. Wesche.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-243147, Price codes: A05 in paper copy, A01 in microfiche. Completion Report January 1983. 89 p, 2 Fig, 3 Tab. OWRT A-030-WYO(1), 14-34-0001-2154.

Descriptors: *Climatic data, *Stream gages, *Hydrologic data, *Weather data collections, Hydrologic systems, Anemometers, Precipitation, Humidity, Temperature, Wind, Wind gages, *Data collections, Upper North Platte River Basin, Snowy Range, *Wyoming, Medicine Bow National Forest, Nash Fork Creek Drainage.

Data for 1982 climatologic and 1982 water year streamflow from the Snowy Range Water Resources Observatory are presented in this report. The Snowy Range Observatory are presented in this report. The Snowy Range Observatory is located in the Nash Fork Creek drainage of the Medicine Bow National Forest in the upper North Platte River Basin. Included in the Observatory are 21 recording precipitation gages, six recording hygrothermographs, five anemometers and seven streamflow gaging stations.
W83-03675

AGRO-ECOLOGICAL REGIONS OF WESTERN RAJASTHAN,
Central Arid Zone Research Inst., Jodhpur (India). Div. of Basic Resources Studies.
For primary bibliographic entry see Field 2A.
W83-03850

8. ENGINEERING WORKS

8A. Structures

PERFORMANCE IMPROVEMENT WITH BROAD-CROWNED SPILLWAYS (LEISTUNGSSTEIGERUNG BREITKRONIGER UBERFALLE),
Technische Univ., Dresden (German D.R.). Bereich Hydrobiologie.
G. Bollrich, and M. Rohner.
Wasserwirtschaft-Wassertechnik, Vol 32, No 7, p 235-237, July, 1982. 5 Fig, 8 Ref. (No English Summary).

Descriptors: *Hydraulic design, *Fluid mechanics, *Weirs, *Reservoir capacity, *Hydraulic profiles, Hydraulics, Hydraulic engineering, Hydraulic models, Model studies, Hydraulic geometry, Hydraulic loading, Dams, Reservoirs, Flood control, *German Democratic Republic, Theoretical analysis, Dam design, Dam construction, Spillways.

In practice, the design the front leading edge of broad- or flat- crowned weirs or spillways causes an energy loss (resulting from constriction or separation of flow and abrasion) that is expressed as a reduction of the spill factor C when compared with theoretical values. The use of a sharp-edged weir (the standard profile) in which the overflow profile conforms to the form of the lower flow surface, affords better hydraulic qualities and results in a higher C value. According to a theory that regards the standard profile as an uplift pressure profile, an increase in outflow of 61% is to be expected with a standard profile as compared to a broad-crowned weir when actual spill height (h)/ design spill height (hD) = 3. Boundary breakaway and flow separation can be avoided for weirs with standard profile with inbuilt uplift pressure as long as $h > 3.0 \times hD$. With this type of profile, the spill factor increases with increasing outflow, making it possible for the usable storage space of a reservoir to be enlarged. A lower spill height is required for flood relief, so that the weir crown can be raised. However, construction materials must be strong enough to withstand the uplift pressure with its associated possible pulsations and local cavitations. Theoretical studies and a hydraulic model experiment were conducted to investigate the possibility of transforming a broad-crowned weir in the German Democratic Republic into a weir with standard profile to make better use of its reservoir capacity. Results showed that the best solution was to construct a ramp with an uplift pressure profile at the front edge of the weir that was 0.60 m above the inflow edge. The broad-crowned inflow edge, with its advantages of low stress on the foundation, separation of hydraulic and excavation work, simple form, and low excavation requirements, was retained. Reservoir capacity could thereby be increased by 1.5 million cu m. (Gish-FRC)
W83-03518

THE WEINZODL POWER PLANT ON THE MUR (DAS MURKRAFTWERK WEINZODL),
Suiselectra Ingenieurunternehmung A.G., Basel.
W. Schaufelberger.
Wasserwirtschaft, Vol 72, No 5, p 195-200, May, 1982. 6 Fig. English summary.

Descriptors: *Hydroelectric plants, *Hydraulic engineering, *Dam construction, *Groundwater management, *Weirs, Mur river, *Austria, Groundwater movement, Computer models, Model studies, Construction, Engineering geology, Geology, Bedrock, Porous media, Percolation, Turbines.

The Weinzodl power plant on the Mur river near Graz (Austria) is a low-head, run-of-river facility composed of weir and machine house and having an installed capacity of 16 MW. The machine house on the left bank is fitted with two Straflo turbines (horizontal-axial, double-regulated turbines with outer-rim generators) and adjoins the three-field weir. Each turbine is designed for 90 cu m/sec water volume with a 9.8-m drop. The weir and machine house were constructed in a common excavation that is bounded by an upstream cofferdam (an earth dam sealed by a concrete louvered slide), a right-sided excavation seal with concrete louvered slide, a downstream cofferdam with louvered sealing slide, and a left-sided excavation seal with concrete louvered slide in the existing terrain. The entire 420-m perimeter is sealed in the porous bedrock (dolomite and sandstone) by a 15-m-deep injection curtain. This design was chosen to avoid influencing the groundwater insofar as possible, since Graz is situated in a groundwater protection area. Numerous computer simulation models of groundwater movement in the power plant's catchment area and calculations of flow through and under the excavation seal were undertaken to determine the degree of sealing required. An injection curtain was constructed to lengthen the percolation pathway from the upstream to the downstream side of the weir to ensure adequate resistance against shear stress (caused by increased water pressure resulting from the impoundment). The weir consists of a steel concrete sill and piers with three segment sluice gates with extension flaps. A small power plant utilizes the drop to the mill canal that branches off at a 45-degree angle near the right weir pier. Construction work was limited to a small area, since the plant was built at the site of a previous weir. Where the river banks were altered, they were planted with new trees and shrubs. (Gish-FRC)
W83-03526

LAKE WEIR DESIGNED TO RESIST ICE DAMAGE,
Oakland County Drain Commissioner's Office, Pontiac, MI.
G. Yrjanainen.
Public Works, Vol 113, No 8, p 62-63, August, 1982. 3 Fig.

Descriptors: *Weirs, *Ice, *Control systems, Water level, Orchard Lake, *Michigan Manholes, Damage, Lake ice.

A lake level control device in Orchard Lake, Michigan, was relocated 20 ft onshore to escape damage by windblown ice floes each spring. The land-locked lake overflows through a 24 inch pipe into Cass Lake across the road. The new adjustable weir control structure was housed in a 9 ft diameter masonry manhole and connected to Orchard Lake by an 18 x 29 inch corrugated metal pipe arch. The inflow pipe coupling was made of flexible material to allow movement with the ice. The structure has survived 2 severe winters without damage. (Cassar-FRC)
W83-03681

MANAGEMENT MODEL FOR POWER PRODUCTION FROM A GEOTHERMAL FIELD: 1. HOT WATER RESERVOIR AND POWER PLANT MODEL,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
T. Maddock, J. W. Mercer, and C. R. Faust.
Water Resources Research, Vol 18, No 34, p 499-512, June, 1982. 10 Fig, 6 Tab, 23 Ref.

Descriptors: *Powerplants, *Management, Model studies, Geothermal power, Geothermal resources, Water resources development.

Mathematical models are developed to determine the amount and rate of conversion to electric power for one particular source of geothermal energy, a liquid-dominated, hydrothermal reservoir. Two models are presented. The first is a model for a reservoir and relates the change in pressure to the extraction or injection of hot water at well sites. The second model is for a power plant and determines the intensive electrical power output, the intensive cooling requirements, and the stream quality mass fractions for the various components of a steam-flash, two stage, turbine condenser power plant connected to the well sites considered in the reservoir model. Capital costs, variable costs and annual fixed costs are obtained for the reservoir development, extraction and reinjection, the transmission system and the power plant. Revenues are dtermined for electrical power production. Application of the management model to a simplified yet realistic example reservoir demonstrated that the methodology developed herein can be used for analyzing the management of an integrated geothermal reservoir power plant system. For the example reservoir, 12 potential sites are developed, five for extraction wells and seven for injection wells. The wells on these sites are used to develop up to 27 MW of electrical power over a 20 year time interval. (Baker-FRC)
W83-03761

8B. Hydraulics

HYDRAULICS OF SOLVING UNSTEADY DEBRIS FLOWS,
Utah Water Research Lab., Logan.
R. W. Jeppson, and S. A. Rodriguez.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-235507, Price codes: A05 in paper copy, A01 in microfiche. Utah Water Research Laboratory Hydraulics and Hydrology Series UWRL/H-83/03, June 1983. 88 p, 14 Fig, 16 Tab, 12 Ref, 3 Append. OWRT A-053-UT(2), 14-34-0001-1147.

Descriptors: *Debris flow, *Open channel flow, Mud flow, Flow density, *Flow viscosity, Energy loss, Fluid mechanics, Computer programs, Hydraulics.

Debris flows consist of movements of water so heavily laden with soil that the density is roughly twice that of water. Due to the many large solid particles, the viscosity of the mixture is many times that of water and large enough to cause the flow to exhibit typical laminar flow characteristics in which adjacent layers slide with respect to each other rather than intermix as occurs in turbulent flow. Hydraulic analysis of the flow requires an

equation for estimating headloss from density and viscosity and a framework for computing depths and velocities for the unsteady flow situations that occur in actual debris flows. A modified Chezy equation and DeLeon's relationship for relating energy loss to density and viscosity were previously combined into an equation for estimating friction slope in a steady-state debris flow. This report presents a computer program for calculating velocities and profiles for unsteady open channel debris flow. The method assumes that the debris flow has a leading surge followed by steady-state but gradually varied flow and extending back to the beginning of the channel. For the computations, data are provided on channel geometry, and slope. Applications are made to compare the solutions with measurements of known debris flows. W83-03608

USING WATER DISTRIBUTION SYSTEM MODELS,

Army Engineer Waterways Experiment Station, Vicksburg, MS.
T. M. Walski.

Journal of the American Water Works Association, Vol 75, No 2, p 58-63, February, 1983. 3 Fig, 31 Ref.

Descriptors: *Pipes, *Model studies, *Water pressure, Water distribution, Computer models, Water demand, Water use, Maps, Network design.

Practical guides for using water distribution system models are given. The user must first decide between a simulation or optimization approach. Simulation models give heads and consumption at all nodes and flows through all pipes and elements. Optimization programs yield pipe sizes, pump heads, or pipe locations to achieve an objective such as minimizing costs while meeting pressure constraints and water demands. Steady-state models solve the network at only one point in time and are useful for design. Unsteady-state models simulate system behavior at successive steps over time, indicating varying water use, pump and valve operation, and heads at reservoirs. Suggestions are given for choosing a program. Maps should fit on a single sheet, even if wall-sized. Skeletal systems, which eliminate many small-diameter pipes, produce acceptable results with less work. C factors (pipe friction factor) are usually set according to literature values and adjusted during model calibration. Two approaches to assigning water use to nodes start with assigning large commercial and industrial users to nodes. Then (1) household water users are aggregated or (2) uses are assigned to nodes on the basis or gpm/node, (gpm/acre) x (acre/node), or (gpm/mi) x (mi pipe/node). Calibration data can often be obtained from fire flow data. (Cassar-FRC)
W83-03641

DISCUSSION: FLOW RESISTANCE IN COARSE GRAVEL BED RIVERS,

Canada Centre for Inland Waters, Burlington (Ontario).
P. Engle, and A. R. Thomas.

Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 108, No HY6, p 803-808, June, 1982. 3 Fig, 1 Ref.

Descriptors: *Sediment transport, *Gravel, *Flow resistance, River beds, *New Zealand, Bed load, Roughness coefficient, Statistical analysis.

Two discussions on the paper, 'Flow Resistance in Coarse Gravel Bed Rivers,' by G. A. Griffiths, published in the Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers in July, 1981, are given. The paper presented a comprehensive data set of hydraulic variables for New Zealand gravel bed rivers. Data were divided into rigid bed and mobile bed categories. P. Engle criticizes several equations in the original paper and explains the reasons for the perceived errors. A. R. Thomas comments on the statistical aspects of the paper and some of the conclusions reached. (Cassar-FRC)
W83-03644

DISCUSSION: BOUNDARY SHEAR IN SMOOTH AND ROUGH CHANNELS,

National Technical Univ., Athens (Greece). Applied Hydraulics Lab.
G. C. Noutsopoulos, and P. A. Hadjipanos.

Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 108, No HY6, p 809-812, June, 1982. 2 Fig, 5 Ref.

Descriptors: *Hydraulic friction, *Boundary conditions, *Channel flow, Shear stress, Open channel flow, Flow characteristics.

The paper, 'Boundary Shear in Smooth and Rough Channels,' by D. W. Knight, published in the Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers in July, 1981, conceived an empirical relationship for the separation of mean wall and bed shear stresses in small rectangular open channels. The writers of this discussion have done similar work on simple and compound rectangular cross sections using the Preston tube and the velocity profiles method for measuring boundary shear stress. In general, results from the above paper and writers' work agreed closely. They also agree that the average wall and bed shear values become equal at an aspect ratio of 2.34 (2.4 in Knight's work). (Cassar-FRC)
W83-03652

DISCUSSION: MINIMUM SPECIFIC ENERGY IN COMPOUND OPEN CHANNEL,

Queensland Inst. of Tech., Brisbane (Australia).
R. G. Black, and D. D. Franz.

Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 108, No HY6, p 798-802, June, 1982. 2 Tab, 1 Ref.

Descriptors: *Channel flow, *Nonuniform flow, *Velocity distribution, *Open channel flow, *Energy, Compound channels, Critical depth, Hydraulic properties, Fluid mechanics, Flow velocity.

M. W. Blalock's and T. W. Sturm's paper, 'Minimum Specific Energy in Compound Open Channel,' published in the Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, in June, 1981, is criticized because the parameter, Fc, developed to predict the critical condition in these channels is not satisfactory. It has not been proven that Fc can yield three critical depths, that it is appropriate for use with the gradually varied flow equations, or that the greatest depth at which Fc = 1 is the proper limit of subcritical flow. R. G. Black feels that the authors are mistaken in assuming that all minimum energy points in a compound channel represent critical conditions. D. D. Franz's discussion on the above paper points out that a uniform velocity distribution in compound channels cannot be assumed. The extension of critical depth concepts to channels with nonuniform velocity distributions is uncertain, and more experimental studies are needed. (Cassar-FRC)
W83-03653

SIMPLIFIED MATHEMATICAL MODEL OF UNSTEADY FLOW IN COMPLEX CHANNEL SYSTEMS,

A. A. Zibert.

Water Resources (English Translation), Vol 9, No 2, p 177-184, March-April, 1982. 3 Fig, 1 Tab, 14 Ref. Translated from Vodnye Resursy, No 2, p 89-98, March-April, 1982.

Descriptors: *Unsteady flow, *Model studies, Mathematical equations, Flow, Flood control, Open channel flow, *USSR, Lielupe River.

Calculation of unsteady flow in open channels are needed for solving various practical problems of hydraulic engineering and water management construction. For complex floodplains and river deltas a model of unsteady flow is used in which the floodplain is represented in the form of individual compartments or chambers interconnected by canals and spillways and separated by a system of dams and dikes. Bank storage, that is, water exchange between the surface flow and soils composing the floodplain, has a substantial effect on unsteady flow along the channel. The practical use of a proposed model is shown for the example of calculating wind setup-setdown phenomena and floods in the lower and middle course of the Lielupe River. The key problem of the investigated model is the division of the channel net into calculation compartments. The conditions affecting the selection of the boundaries between the compartments can be divided into the following three groups: first, the topographic characteristics of the channel and floodplain; second, the formal requirements following from the main assumptions of the model examined later, and third, the degree of detail of the available hydrometric, topographic, and hydrogeological information. The experience of using the investigated mathematical model of unsteady flow on a number of real objects indicates that it can be used for complex flatland channel systems. (Baker-FRC)
W83-03759

SEPARATION OF HYDRAULIC FLOW OVER TOPOGRAPHY,

Cambridge Univ. (England). Dept. of Applied Mathematics and Theoretical Physics.
H. E. Huppert, and R. E. Britter.

Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 108, No HY12, p 1532-1539, December, 1982. 5 Fig, 11 Ref.

Descriptors: *Flow separation, *Topography, *Sheet flow, Subcritical flow, Flow pattern, Flow obstruction, Flow around objects.

The hydraulic flow of a single layer of fluid will separate on the lee surface of a smooth topographic feature whenever the flow is subcritical everywhere, unless the height of the feature is very small. Results from open channel flume tests confirmed the validity of the theoretical equation. Conditions for flow separation in a two-layer flow were also determined. (Cassar-FRC)
W83-03830

8C. Hydraulic Machinery

DEVELOPMENT OF SUITABLE CLOSURE SPECIFICATIONS FOR REMOTE CONTROLLED BALL VALVES TO LIMIT WATER HAMMER IN PIPELINES OF THE ZWECKVERBAND LANDESWASSERVERSORGUNG STUTTGART (ENTWICKLUNG GEEIGNETER SCHLIESSGESETZE ZUR DRUCKSTOSSBEGRANZUNG BEI FERNGESTEUERTEN KUGELSCHIEBERN IN DEN FERNWASSERLEITUNG DES ZWECKVERBANDES LANDESWASSERVERSORGUNG STUTTGART),

Zweckverband Landeswasserversorgung, Stuttgart (Germany, F.R.).
D. Flinspach, J. Giesecke, and H. B. Horlacher.

Wasserwirtschaft, Vol 72, No 5, p 201-206, May, 1982. 11 Fig, 6 Ref. English summary.

Descriptors: *Conveyance structures, *Automation, *Water pressure, *Hydraulic valves, *Fluid mechanics, Water distribution, Hydraulics, Hydraulic properties, Ball valves, Drum valves, *Federal Republic of Germany, Stuttgart, Pressure distribution, Water mains, Pipelines, Reservoirs, Distribution reservoirs, Water conveyance.

The development of closure specifications for ball valves installed in the Stuttgart (Federal Republic of Germany) area water conveyance system is described. Installation of the valves was rendered necessary by the conversion of the network to an automatically controlled system because the existing pressure regulators, float-controlled drum valves, had to be closed manually if the regulating reservoir was full and inflow had to be completely shut off. The ball valves supplement the drum valves, which remain operational as long as they are self-controlled. Water hammer measurements and hydraulic studies were conducted to clarify the hydrodynamic criteria of the closing processes at the valves and the resulting pressure increases. Two measuring stations were set up: one with one measuring point and the other, at the regulating reservoir Oberberken on a steel gravity-feed water

main, with three (directly in front of the ball valve, at the Venturi tube, and in the short oscillating pipeline that leads from the main to the standpipe serially connected to the reservoir). The measured water hammer curve showed that water hammer built up to its highest value after about 3.5 min of continuous valve closing (at about a 25% closure angle) and gradually dissipated as it passed the measuring points. Throttling characteristics for ball and drum valves wereconsidered separately. The Oberberken results were used to develop optimal closure specifications. A three-step procedure is recommended. The first step lasts 2 min, wherein the valve proceeds from being completely open to 70% closed; in the second step (6 min) it progresses to 85% closed, and in the final 2-min step it proceeds to full closure. (Gish-FRC)
W83-03524

MAINTENANCE DREDGING IN THE PORT OF BRISTOL,
G. Foy.
World Dredging and Marine Construction, Vol 18, No 12, p 16-21, December, 1982. 9 Fig, 2 Tab.

Descriptors: *Dredging, *Siltation, *Hydraulic equipment, Basins, Ports, Bristol Port, Severn Estuary, Estuaries, Maintenance, *England.

The Port of Bristol Authority maintains and operates three impounded dock systems adjacent to the point where the River Avon joins the Severn Estuary, namely Portishead Dock, Avonmouth Docks and the Royal Portbury Dock. The Severn estuary has a very high tidal range, varying between 40 and 50 feet in spring tides; a very large amount of fine silt is held in suspension. Tidal channels are generally self-scouring, except for certain small local areas which show a siltation pattern attuned to the effects of local rainfall and some estuarial shoaling which has a cyclic pattern of movement. The siltation which requires dredging is located at the entrances to the various docks. To reduce the amount of such siltation pumping takes place after the high silt content times on the making of spring tides. At the city docks the bulk of the siltation arrives through the entrance and deposits mainly in the Cumberland Basin. Machinery used to perform the dredging process is described. (Baker-FRC)
W83-03539

THE MECHANICAL AND ELECTRICAL ASPECTS OF THE REMODELING OF KEMPTON PARK WORKS,
M. R. Dowding, and D. M. Clark.
Journal of the Institution of Water Engineers and Scientists, Vol 36, No 5, p 354-368, September, 1982. 5 Fig, 3 Tab, 3 Ref.

Descriptors: *Water treatment facilities, *Design criteria, Pumps, Motors, Butterfly valves, Valves, Mechanical equipment, Financial aspects.

The history and a description of the Kempton Park Works are outlined, together with the factors that led to the remodelling of the water works. Before remodelling the works had two storage reservoirs, primary filters, secondary filters, chemical treatment plant, and two engine and boiler house complexes. In the new plant the pumps are of the vertical spindle, single stage, split casing centrifugal type. Pipe diameters range from 450 to 1200 mm nominal diameter. Within the suction and delivery manifold and associated mains there are a total of twenty-five butterfly or sluice valves ranging from 450 to 1200 mm nominal bore, all provided within the pump and motor contract. On the basis of experience gained since the shutdown of the steam based plant the estimated cost of operating the remodeled works (in pence) has decreased to 4.9 p/water kWh from the extrapolated value for 1980/81 of about 12p. The figures reflect the reduction in number of employees from 54 to 24. It is also estimated that the overall efficiency of the works pumping operation has been increased from about 11.6% to 23.5%. (Baker-FRC)
W83-03586

NATURAL GAS PROVES TO BE ECONOMICAL FOR PUMPING WATER,
Needham Public Works Dept., MA.
B. E. Nagler.
Public Works, Vol 113, No 8, p 68-69, August, 1982. 1 Tab.

Descriptors: *Pumps, *Natural gas, *Costs, Energy sources, Needham, *Massachusetts, Operating costs.

Natural gas was the most economical energy source for the new well pumping station at Needham, Massachusetts, in 1974. A Ford 534 V-8 truck engine was installed to pump the well at a rate of 1 mgd. Use of the gas engine saved $19,100, compared with electricity, for the years 1977-81. However, repairs have been a problem because some parts are difficult to obtain and troubles are difficult to diagnose. Although the engine itself has been long-lived, many appurtenances have worn out. Efficiency could be further improved by pumping nearer to 100% of the time rather than the 50-80% as experienced thus far. (Cassar-FRC)
W83-03715

GEOMETRIC CHANGES BRING LOBE PUMPS INTO SEWAGE SLUDGE MARKETS.
World Water, Vol 5, No 12, p 31, December, 1982.

Descriptors: *Pumps, *Sludge, *Lobe pumps, Rotors.

Lobe pumps, which have no pistons or valves, have been adapted to pump low viscosity fluids such as water and sewage sludge. The modification prevents slippage of fluid through the gap between rotor and casing by departing from the circular shape. This change generally improves performance by 15%. Rubber-lined rotors are available wherever a suction lift is needed or if the fluid contains abrasive particles. (Cassar-FRC)
W83-03742

8D. Soil Mechanics

DYNAMIC ANALYSIS OF EARTH DAMS IN THREE DIMENSIONS,
Harding-Lawson Associates, Novato, CA.
L. H. Mejia, H. B. Seed, and J. Lysmer.
Journal of the Geotechnical Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 108, No GT12, p 1586-1604, December 1982. 13 Fig, 1 Tab, 23 Ref.

Descriptors: *Earthquakes, *Seismic waves, *Dam stability, Oroville Dam, *California, *Earth dams, Rockfill dams, Canyons, Model studies, Soil mechanics, Strain measurement.

Finite element techniques were used to describe the three-dimensional dynamic response of earth and rockfill dams to seismic disturbance. This method is useful in studying dams built in narrow canyons, which are only approximately described by plane strain conditions. The dynamic response of the Oroville Dam, California, during the August 1, 1975, earthquake and the dynamic material properties of the dam were evaluated using the proposed method. Back-calculation of the dynamic properties of the dam materials indicates that a K2max value of 170 is representative of the situ dynamic characteristics of the dam's gravels and cobbles. There was reasonable agreement between this value and the laboratory-measured values on scaled samples of the dam shell material and between the computed and recorded response of the dam. (Cassar-FRC)
W83-03651

FACTORS AFFECTING STRESS CELL MEASUREMENTS IN SOIL,
Haley and Aldrich, Inc., Cambridge, MA.
W. A. Weller, Jr.,, and F. H. Kulhawy.
Journal of the Geotechnical Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 108, No GT12, p 1529-1548, December, 1982. 9 Fig, 2 Tab, 38 Ref.

Descriptors: *Soils tests, *Stress cells, *Measuring instruments, Soil mechanics, Soil structure, Construction, Soil engineering, Soil properties.

Factors affecting stress cell measurements in soil are reviewed. Stress cells can be of two types: flexible diaphragm cells and stiff cylinder (or rigid piston) cells. Some common systems used to measure stress cell reponse are: resistance strain gage, vibrating wire strain gage, semiconductor strain gage, closed fluid system with pressure transducer, pneumatic systems, and solid semiconductor elements. Factors affecting stress cell measurements are listed in a table with the description of error and correction methods. Factors are: aspect ratio (cell thickness to diameter ratio); soil-cell stiffness ratio; diaphragm deflection (arching); cylinder of piston cell deflection; stress concentrations at cell corners; eccentric, nonuniform and point loads; lateral stress rotation; cross sensitivity; stress-strain behavior of soil; placement effects; proximity of structures and other stress cells; dynamic stress measurements; corrosion and moisture; placement stresses; and temperature. (Cassar-FRC)
W83-03657

8G. Materials

DISCUSSION: LONG-TERM PERFORMANCE OF EMBANKMENT DAM INSTRUMENTATION,
Water Resources Commission of New South Wales, Sydney (Australia).
A. C. Houlsby, and J. Dunnicliff.
Journal of the Geotechnical Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 108, No GT8, p 1091-1095, August, 1982. 2 Ref.

Descriptors: *Piezometers, *Pressure-measuring instruments, Embankments, Dams, *Measuring instruments, Bactericides, Performance evaluation, Maintenance.

The above-titled paper by John Dunnicliff, presented at the American Society of Civil Engineers International Convention, New York, New York, May 11-12, 1981, was the subject of two discussions. Houlsby endorsed the original author's preference for twin tube hydraulic piezometers and suggested practices for enhancing their service life and for renovating deteriorated systems. These practices included the use of quaternary ammonium bactericides in the water filling the tubes, vacuum flushing of the tubes, Boudon pressure gages arranged to avoid valve manipulation during readings, and a simple layout of lines and equipment. Kleiner and Logani suggested more reliable systems for monitoring performance of dams and foundations such as pneumatic piezometers and vibrating wire piezometers. The author replied to the discussions by reemphasizing the longevity of twin tube hydraulic piezometers. (Cassar-FRC)
W83-03642

DISCUSSION: PIEZOMETERS IN EARTH DAM IMPERVIOUS SECTIONS,
Slope Indicator Co., Seattle, WA.
P. E. Mikkelsen, and J. L. Sherard.
Journal of the Geotechnical Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 108, No GT8, p 1095-1099, August, 1982.

Descriptors: *Piezometers, *Pressure-measuring instruments, Pore water, Earth dams, Dams, Embankments, *Measuring instruments.

Comments on the above-titled paper, presented by James L. Sherard at the American Society of Chemical Engineers International Conference, New York, New York, May 11-12, 1981, disagree with the heavy emphasis on measuring subatmospheric pore water pressure and the strong endorsement of vibrating wire piezometers. A pneumatic, venting type piezometer is suggested for this purpose. The advantages and disadvantages of the pneumatic and vibrating wire diaphragm piezometers are discussed. Pneumatic tubing is limited to about 1000 m; vibrating wire leads function to at least 4000 m. Electrical storms or high voltage cannot damage pneumatic tubes but will disable vibrating wire systems. Pneumatic tube piezometers are easier to calibrate and 4-10 times less in

cost than vibrating wire piezometers. However, the vibrating wire system is more adaptable to automatic data handling. In reply Mr. Sherard reiterated some of the technical advantages of vibrating wire piezometers and also pointed out that wires are less likely to be damaged during construction or later by dam deformation. (Cassar-FRC)
W83-03643

THE INTERIOR SURFACE OF GALVANIZED STEEL PIPE: A POTENTIAL FACTOR IN CORROSION RESISTANCE,
Montgomery (James M.), Inc., Pasadena, CA.
K. P. Fox, C. H. Tate, and E. Bowers.
Journal of the American Water Works Association, Vol 75, No 2, p 84-86, February, 1983. 5 Fig, 1 Tab, 6 Ref.

Descriptors: *Corrosion, *Pipes, Steel, Zinc, Copper, Plumbing, Thickness specification, Australia, Korea.

Samples of ASTM A-10 galvanized steel pipe manufactured in the U.S., Australia, and Korea were examined as part of a study on pitting corrosion. Visual examination showed that the inner surface of the Australian pipe was relatively smooth and uniform, the Korean pipe was generally smooth with isolated blemishes and a ridge along the weld, and the U.S. pipe was most variable in surface characteristics, with color and texture variations along its entire length. The zinc coating met thickness specifications and was uniformly smooth on the Australian pipe, met thickness specifications but was substantially heterogeneous on the U.S. pipe, and was below specifications with intermittent surface anomalies on the Korean pipe. A pilot test with water containing copper doses of 0.05 to 5.0 mg per liter is underway to determine the effects of coating irregularities on corrosion. (Cassar-FRC)
W83-03650

A STUDY OF THE OCCURRENCE OF HYDROGEN SULFIDE IN SEWERS IN THE PIEDMONT AREA OF SOUTH CAROLINA,
Clemson Univ., SC. Dept. of Civil Engineering.
P. B. Zielinski, and L. E. Fay.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-243105, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Research Institute Publication No 106, June 1983. 49 p, 13 Fig, 5 Tab, 10 Ref, 1 Append. OWRT A-046-SC(1), 14-34-001-9043, 8043, 0143.

Descriptors: *Hydrogen sulfide, *Corrosion, *Sewer systems, Wastewater facilities, *Interceptor sewers, Sewer gas, Sewage bacteria, Lateral sewers, *South Carolina Piedmont.

This project involved a two year investigation of the occurrence of hydrogen sulfide in interceptor sewer lines in the Piedmont of South Carolina. The study was conducted in two parts, including the earlier survey of Piedmont communities according to known situations of hydrogen sulfide occurrence, and the followup field work which involved the determination of suitable sites for further study of hydrogen sulfide occurrence. The purpose of the study was to determine whether sufficient sulfide generation existed to cause corrosion problems and to determine the applicability of the sulfide generation model of R. D. Pomeroy to the South Carolina Piedmont. In most cases less than 0.5 ppm of sulfide was found which is considered insufficient to cause a corrosion problem. Comparison of data to the earlier Pomeroy Z-parameter and the EPA flow-slope relationship also verified that no serious corrosion situations existed in the lines that were studied. Attempts were made to follow discrete slugs of sewer flow in an attempt to verify the Pomeroy generating model, but insufficient concentration changes were observed to verify the equation.
W83-03671

8I. Fisheries Engineering

AQUACULTURE TECHNIQUES: A COMPUTER SIMULATION OF AN INTENSIVE FISH CULTURE SYSTEM (AQUA),
Idaho Univ., Moscow. Coll. of Forestry, Wildlife and Range Sciences.
G. W. Klontz, J. A. McNair, and T. McArthur.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-246405, Price codes: A03 in paper copy, A01 in microfiche. Idaho Water and Energy Resources Research Institute Completion Report, Moscow, July 1982. 50 p, 18 Ref, 1 Append. A-063-IDA(3), 14-34-0001-0216.

Descriptors: Computer models, *Computer simulation, *Fish hatcheries, Fish management, *Aquaculture, Model studies, *Idaho, Education, *Training.

AQUA is a computer simulation model used for teaching fish culture concepts. In this model, the student functions as a hatchery manager and must program fish growth, monitor pond loadings, treat diseases and make various calculations concerning the interactions of fish, water, container, nutrition and management using a group of rainbow trout. As the student's objective, a product definition is presented at the beginning of the model and is used as a standard for comparison for feedback comments on how well the student 'grew' the fish. A handout containing the necessary equations and information for using AQUA proficiently complements the model to guide inexperienced fish health managers. AQUA is currently being used by students of fish culture and disease at the University of Idaho Department of Fisheries Resources to reinforce and apply concepts taught in the classroom.
W83-03685

9. MANPOWER, GRANTS AND FACILITIES

9D. Grants, Contracts, and Research Act Allotments

EVALUATION OF ALTERNATIVE PROCEDURES FOR REVIEW OF WATER RESOURCES RESEARCH PROPOSALS,
Massachusetts Univ., Amherst. Water Resources Research Center.
B. B. Berger, and E. R. Kaynor.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-235325, Price codes: A04, in paper copy, A01 in microfiche. In proceedings, workshop at New England Center for Continuing Education, Durham, NH, June 18-19, 1975. Univ. of Massachusettes, Amherst, September 1975. 59 p, 7 Tab, 3 Appen. OWRT B-061-RI(7), 14-31-0001-3953.

Descriptors: *Research needs, *Research priorities, Funds, *Management planning, Water Research Institutes, *Federal funding, Evaluation, Conferences.

A workshop was held June 18 and 19, 1975 at Durham, New Hampshire to consider the question: given limited funds, how should funding agencies choose among project grant applications. After considering presentations by various Federal agency personnel, participants concluded that methods of evaluating research project grant applications differed extensively in practice, some depending in part on objectified scoring systems, but most depending heavily on qualitative, professional judgment. A University of Massachusetts 'exercise' was also considered. This involved the reactions of two sets of evaluators: 'gut' reactors (practitioners) and 'programmed' reactors (institute directors). Proposals were presented in the form of Office of Water Research and Technology Executive Summaries. While there were obvious limitations connected with this study (too little time, lack of agreement on best evaluation criteria and scaling methods, too few responses, and too limited presentation of proposal substance), study results were still surprising. It appeared to make little difference whether respondents were asked to use judgmental criteria or objective criteria. Perhaps more important, individuals within both groups appeared to differ randomly in their reactions.
W83-03600

10. SCIENTIFIC AND TECHNICAL INFORMATION

10C. Secondary Publication And Distribution

WATER RESOURCES BIBLIOGRAPHY OF HAWAII,
Hawaii Univ. at Manoa, Honolulu.
F. N. Fujimura, and E. T. Murabayashi.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-251066, Price codes: A12 in paper copy, A01 in microfiche. Technical Report No 149, March 1983. 264 p. OWRT A-083-HI(1), 14-34-0001-1113.

Descriptors: *Bibliographies, Water Resources-Center, *Hawaii, *Documentation, Classification, Information exchange, Publications.

The previous Water Resources Research Center bibliographies (Technical Report Nos. 50 and 88) were evaluated by the project staff, assisted by an advisory committee how this bibliography could be improved. As a result of the discussion and evaluation, the order and presentation of the entries in the Annotated Listing were revised. The former three-part code was simplified to a two-part code consisting of the first five letters of the primary author's last name and the last two digits of the year of publication. The title of the report or article is displayed first in bold type form readability, followed successively by the annotation; author(s); keywords; repository, including the call number; and then by the facts of publication, such as the journal name, volume, number, inclusive pages, and the year of publication. Although the original research approach was to include publications issued between 1971 through 1978, earlier as well as more recent publications have been included. Secondary sources of information that were also used in compiling information included the Engineering Index, Selected Water Resources Abstracts, and the Water Resources Scientific Information Center.
W83-03730

SUBJECT INDEX

ACETYLENE REDUCTION
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